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EVOLUTION; BIRDS ATTACKING LEPIDOPTERA; PREDATORS AND PARASITES; BRITISH, ARCTIC AND BORNEAN FAUNA; ECOLOGY; TAXONOMY AND SYSTEMATICS; REVIEWS AND OBITUARY; DEPARTMENTAL REPORTS 1935—1938.

EDITED BY

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PREFACE

This volume contains papers arranged in the following groups: (A) Evolution; (B) Birds attacking Lepidoptera; (C) Predators and Parasites; (D) British fauna; (E) Arctic fauna; (F) Bornean fauna; (G) Ecology; (H) Taxonomy and Systematics; (I) Reviews and obituary; (J) Annual Reports of the Hope Professor.

Group A. The first paper is the presidential address to the British Association for the Advancement of Science, delivered by the Emeritus Professor in 1937, and dealing with the history of evolutionary thought as recorded by the Association. No. 2, by the same author, is another survey in which fifty years of study of protective resemblances in insects are briefly reviewed.

The influence of Charles Darwin upon Entomology, No. 3, forms the subject of an address by the Professor, and No. 4, by the same author, is a contribution, on Entomology and Natural Selection, to a discussion at the British Association; a similar subject forms item No. 5.

Comments by the Professor upon variation in cryptic Lepidoptera, and upon the behaviour of New Zealand birds to the introduced cinnabar moth, are numbered 6 and 7. A note by Dr. B. M. Hobby and the Emeritus Professor, No. 14E, concerns *Halictus* bees and their Dipterous Conopid mimics.

Group B. Birds as enemies of butterflies form the subject of items 8 and 9, by the Professor; No. 10 contains an interesting account by Mr. T. W. Kirkpatrick of swifts feeding their young on an Arctiid moth, and a note by Mr. F. Dowsett on great tits feeding upon butterflies; a similar note on a thrush by Mr. R. Cottam forms item No. 11. A short note by Mr. J. Ford describing the

escape of a captured butterfly from a hedge-sparrow follows as item 14B.

Group C deals with predators and parasites. Item No. 12 is a paper by Mr. L. Parmenter upon predacious flies and their prey, a subject upon which the Emeritus Professor and Dr. B. M. Hobby have contributed many papers to previous volumes of these Reports. Dr. Mary Carleton in No. 13 gives an account of an Ichneumonid parasite of a sawfly: it is described as a new species in an appendix by Dr. Roman. A note on some parasites of *Zygaena* by the Professor forms item 14A; the Emeritus Professor discusses a parasite reared from galls of *Rhodites rosae* in 14D; and in 14H Dr. B. M. Hobby gives a list of parasites bred from British moths. Item No. 15 comprises some records of bred Tachinidae by Mr. E. Taylor.

Group D is concerned with British fauna and commences with a striking study of the fauna of Windsor Forest by Mr. H. St. J. K. Donisthorpe, forming item No. 16. An unexpected richness of species is revealed by this result of many years collecting and study. A short note, No. 40C, by Mr. J. M. Brown deals with the discovery of a rare British species of Collembola in Oxfordshire. Item No. 17, by Mr. E. Taylor, records a few Orthoptera from Worcestershire. Professor L. W. Grensted, D.D., reports in No. 18A the capture on the Thames of a species of caddis-fly new to Britain which Mr. E. W. Aubrook subsequently took in numbers (No. 18B). The same author gives a report on Trichoptera and Plecoptera of the Oxford district in Nos. 24B-C. No. 19, by Mr. W. H. Dowdeswell, continues his account of the Lepidoptera of Cara Island in the Hebrides: special attention is given to a method of estimating the total numbers of a species common on the island, and to the prevalence of melanism. Notes by Lieutenant-Colonel H. D. Peile, I.M.S., communicated by the Professor, on the larva and pupa of the comma butterfly form item No. 20, and

the same species is the subject of a study, No. 21, by the late Commander J. J. Walker, R.N., who investigates its fluctuations in numbers in Great Britain.

The Emeritus Professor in item 22 alludes to the capture in Cornwall of the plume-moth *Agdistis staticis*. No. 14F, by the same author, discusses the alloprocryptic concealment of the larva of the Geometrid *Phorodesma smaragdaria*, of which drawings are furnished by Dr. B. M. Hobby as item 14G. An interesting case of spiral segmentation in a larva of *Hipocrita jacobaeae* is discussed by Mr. E. W. Aubrook in No. 14J.

The next two items, 23 and 24, are reports by the late Commander Walker on Coleoptera and Lepidoptera in the Oxford district in 1935 and 1936, and the same author in No. 25 gives an account of the Coleoptera of the Faroe Islands. A brief note on Anthicidae new to Berkshire and Oxfordshire, by Mr. E. W. Aubrook will be found as No. 14C.

Mr. G. M. Spooner in item 26 describes a new species of the Sphecid genus *Diodontus* which he has distinguished in Britain. A brief note by Mr. F. J. Killington, No. 14I, reports the occurrence of a locally distributed bee, *Andrena marginata*, in Oxfordshire. Item 40B, by Dr. O. W. Richards, gives an account of humble bees collected by Mr. G. Swynnerton on Cara Island, Argyllshire, in which a new variety is described. Lastly, item 27, which is a report by Mr. E. Taylor on some species of woodlice found in the Oxford district.

Group E contains six papers dealing with Arctic insects, of which the first five concern collections by various expeditions of the University Exploration Club and contain descriptions of new species and new records of distribution.

No. 28, by Dr. F. W. Edwards, describes the Diptera of the 1936 expedition to North-East Land, with a note by Mr. A. Thienemann on the interesting pupa of

Orthocladius conformis. The next item, No. 29, by the Professor, is an account of the insects collected in North-west Greenland by the Ellesmere Land Expedition, 1934-35. A new species of *Rhamphomyia* is described by Mr. J. E. Collin. The results of the 1933 expedition to West Spitsbergen are given in No. 30, by the Professor, who also describes in No. 31 the insects collected by the 1936 expedition to West Greenland. Item No. 32, by the Professor and Mr. Ake Holm, gives an account of insects and Arachnida collected by the expedition under Mr. L. R. Wager to East Greenland, a part less known than West Greenland: new results are reported. Mr. J. M. Brown in No. 33 discusses some Collembola from Iceland and Greenland.

Group F describes results of the expedition of the Exploration Club to Borneo in 1932. Item No. 34, by Mr. C. Willemse, deals with Acridiid grasshoppers; in No. 35, Dr. W. D. Funkhouser describes three new Membracidae; the Gyrinid beetles are discussed by Mr. G. Ochs in No. 36; Mr. H. E. Hinton, in Nos. 37 and 38, gives an account of the important collection of Dryopidae, including fourteen new species. Brenthid and Lycid beetles are identified by Mr. R. Kleine in No. 39; Dr. S. Breuning describes a new Cerambycid in No. 40A and three new Lamiinae form the subject of No. 41. In item 42, Professor J. B. Parker deals with the Bembicinae, describing two species of *Bembicinus*, and new species and records of Mutillidae, in No. 43, are described by Mr. C. E. Mickel. Mr. H. F. Schwarz reports in No. 44 on the Meliponid bees, which contain about one-half of the species hitherto known from Borneo in addition to certain new forms; and the last item, 45, is an account of Trypaneid flies by Mr. F. A. Perkins, containing descriptions of a new species and a new variety.

Group G contains papers on ecological subjects. Item No. 46, by Messrs. J. R. Carpenter and J. Ford, deals statistically with the samples of population obtained by the use of a sweep-net in an ecological survey. The

Emeritus Professor in the next two items suggests that the growth of the common dead-nettle is stimulated by the presence of the stinging-nettle.

Group H is concerned with taxonomy and systematics. Blattidae of Madeira are the subject of No. 48, by Dr. R. Hanitsch; Mr. J. Cowley and Miss L. K. Gloyd, in No. 49, discuss the Odonate *Protoneura tenuis*; in No. 50 the Professor summarises his study of the Butterflies of Abyssinia (see 1936, *Hope Reports*, **22**: No. 10); a review of the literature on some European yellow forms of *Pieris napi*, with revision of the names of forms by the Professor and Dr. B. M. Hobby, is item No. 51; and Messrs. H. M. Edelsten and W. H. T. Tams in No. 52 discuss the identity of *Acosmetia morrisii* Dale. A study of the beetle *Calosoma inquisitor* forms item No. 53, by Mr. J. H. Cook. No. 54 comprises an account of types of Ichneumoninae in the national collection and at Oxford: the author, Mr. Gerd Heinrich, discusses synonymy. The genus *Bactria* (= *Promachus*) of Asilid flies in the Ethiopian zoological region forms the subject of item 55 by Dr. B. M. Hobby; and the last item in this section, by Mr. J. C. Chamberlin, describes some new and little-known false scorpions from the Pacific. This communication is in connection with the intensive study of Pacific insular faunas now being pursued by Mr. E. P. Mumford of the Hope Department of Entomology, towards the expenses of which the University is contributing a special grant for a period of five years.

Group I contains reviews and an obituary by members of the Department. Item No. 57 is a review by the Professor of 'The Arachnida' by T. H. Savory; No. 58, by the Emeritus Professor, reviews 'Charles Darwin, the Fragmentary Man,' by G. West; and 'A Catalogue of the African Hesperiidae . . . ,' by W. H. Evans, is reviewed in No. 59 by the Professor. Dr. B. M. Hobby's review of 'Nature Study above and below the surface,' by H. C. Gunton, forms item No. 60, and No. 61 is a

review by the same writer of 'The British Mosquitoes,' by J. F. Marshall. Item No. 62 is an obituary notice of the late R. J. Tillyard by the Professor.

Group J contains the annual reports of the Department for four years commencing with 1934-35.

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February, 1939.

CONTENTS

GROUP A

GROUP B

GROUP C

12. Parmenter, L. 1937. Predacious flies and their prey. *Lond., Nat.*, **1936**: 51-4.

13. Carleton, M. 1937. A new Ichneumonid (*Scopimenus pygobarbus*) parasitic on *Nematus proximus* Lep. (Hym., Tenthredinidae) in Britain: with a description of the adult by Dr. A. Roman. *Ent. Mon. Mag.*, **73**: 61-5.

14a. Carpenter, G. D. H. 1937. A note on some parasites of *Zygaena* (Lep.). *J. Soc. Brit. Ent.*, **1**: 176-8.

14d. Poulton, E. B. 1937. Emergence of the parasitic Ichneumonid *Orthopelma luteator* Grav. from the gall of *Rhodites rosae* (L.). *Ibid.*, **1**: 179.

14h. Hobby, B. M. 1937. Parasitic Hymenoptera bred from British Lepidoptera-Heterocera by H. C. Hayward, M.A., F.R.E.S. *Ibid.*, **1**: 184-5.

15. Taylor, E. 1938. Some records of bred Tachinidae (Diptera). *Ibid.*, **1**: 221-3.

GROUP D

16. Donisthorpe, H. St. J. K. 1936-38. A preliminary list of the Coleoptera of Windsor Forest. *Ent. Mon. Mag.*, **72**: 210-9, 260-7; **73**: 20-8, 70-7, 110-25, 167-76, 237-46, 273-4; **74**: 21-7, 67-77, 115-26, 166-71, 212-22, 259-70.

40c. Brown, J. M. 1936. *Sminthurides schotti* Axels. (Collembola) in Oxfordshire. *Ibid.*, **72**: 118.

17. Taylor, E. 1938. Records of Worcestershire Orthoptera. *Ibid.*, **74**: 210.

18a. Grensted, L. W. 1938. *Setodes lusitanica* McL.: a caddis-fly new to Britain. *Ibid.*, **74**: 189.

18b. Aubrook, E. W. 1938. *Setodes lusitanica* McL. in Oxfordshire. *Ibid.*, **74**: 190.

24b. Grensted, L. W. 1937. Report on Trichoptera and Plecoptera. *Rep. Ashmol. Nat. Hist. Soc.*, **1936**: 18.

24c. ——— 1937. Trichoptera in 1936. *Ibid.*, **1936**: 19.

19. Dowdeswell, W. H. 1937. Further notes on the Lepidoptera of Cara Island. *Entomologist*, **70**: 169-75 (repaged 1-7).

20. Carpenter, G. D. H. 1936. Notes on larvae and pupae of *Polygonia c-album* Linn. (Lep.). *J. Soc. Brit. Ent.* **1**: 146.

21. Walker, J. J. 1938. The comma butterfly, *Polygonia c-album* (Linn.): its decadence and revival as a British insect. *Trans. Soc. Brit. Ent.* **5**: 281-90.

22. POULTON, E. B. 1938. *Agdistis staticis* Millière (Lep., Pterophoridae) taken in Cornwall by Dr. C. H. Andrewes, M.D., F.R.E.S. *J. Soc. Brit. Ent.*, **1**: 230-1.

14F. ———— 1937. Notes on the larvae and pupation of the Geometrid moth *Phorodesma smaragdaria* F. (Lep.). *Ibid.*, **1**: 181-2.

14G. HOBBY, B. M. 1937. Notes on the larva of *Phorodesma smaragdaria* F. (Lep.). *Ibid.*, **1**: 183.

14J. AUBROOK, E. W. 1937. Spiral segmentation in the immature stages of *Hipocrita jacobaeae* L. (Lep., Arctiidae). *Ibid.*, **1**: 136-7.

23. WALKER, J. J. 1936. Interim report on Coleoptera and Lepidoptera. *Rep. Ashmol. Nat. Hist. Soc.*, **1935**: 15-6.

24A. ———— 1937. Interim report on Coleoptera and Lepidoptera. *Ibid.*, **1936**: 17-8.

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14C. AUBROOK, E. W. 1937. Anthicidae (Col.) new to Berks and Oxon. *J. Soc. Brit. Ent.*, **1**: 178-9.

26. SPOONER, G. M. 1938. A new species of the Sphecid genus *Diodontus* occurring in Britain. *Ent. Mon. Mag.*, **74**: 249-55.

14I. KILLINGTON, J. F. 1937. *Andrena marginata* Fabr. (=*cetii* Schr.) (Hym.) in Oxfordshire. *J. Soc. Brit. Ent.* **1**: 185.

40B. RICHARDS, O. W. 1936. On a collection of humble-bees (*Bombus* and *Psithyrus*, Hymenoptera) from Cara Island, Argyllshire. *Ent. Mon. Mag.*, **72**: 109-11.

27. TAYLOR, E. 1936. Report on Oniscoidea (woodlice). *Rep. Ashmol. Nat. Hist. Soc.*, **1935**: 16-7.

GROUP E

28. EDWARDS, F. W. 1937. Oxford University Expedition to North-East Land, 1936: Diptera. With a note on the pupa of *Orthocladius conformis* Holmgr. by A. Thienemann. *Ann. Mag. Nat. Hist.* (10), **20**: 360-4.

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32. ———— and HOLM, Å. 1939. Insecta and Araneae collected in the Kangerdlugsuak Region of east Greenland by the British Expedition, 1935-36. *Ibid.* (11), **3**: 60-80.

33. BROWN, J. M. 1937. On some Collembola from Iceland and Greenland. *Ibid.* (10), **20**: 514-20.

GROUP F

34. WILLEMSE, C. 1938. Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Acridiidae (Orthoptera). *Ibid.* (11), **2**: 217-36.

35. FUNKHOUSER, W. D. 1937. Three new Membracidae from Borneo. *Ent. Mon. Mag.*, **73**: 100-2, pl. 3.

36. OCHS, G. 1937. Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Gyriniden (Coleoptera). *Ann. Mag. Nat. Hist.* (10), **19**: 596-617, pl. 18.

37. HINTON, H. E. 1936. Results of the Oxford University Expedition to Borneo, 1932. Dryopidae (Coleoptera).—Part 1. *Ibid.* (10), **18**: 89-109.

38. ———— 1936. Idem, Part 2. *Ibid.* (10), **18**: 204-24.

39. KLEINE, R. 1937. Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Brenthidae und Lycidae (Coleoptera). *Ann. Mag. Nat. Hist.* (10), **20**: 505-9.

40A. BREUNING, S. 1936. Results of the Oxford University Expedition to Borneo, 1932. A new species of *Dihammus* Thoms. (Coleoptera, Cerambycidae). *Ent. Mon. Mag.*, **72**: 109.

41. ———— 1937. Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Three new species of Lamiinae (Coleoptera, Cerambycidae). *Ibid.*, **73**: 57-8.

42. PARKER, J. B. 1937. Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Bembicinae (Hymenoptera). *Ibid.*, **73**: 129-33.

43. MICKEL, C. E. 1937. New species and records of Mutillidae (Hymenoptera) from Borneo and the Solomon Isles. *Ann. Mag. Nat. Hist.* (10), **19**: 441-56.

44. SCHWARZ, H. F. 1937. Results of the Oxford University Sarawak (Borneo) Expedition: Bornean stingless bees of the genus *Trigona*. *Bull. Amer. Mus. Nat. Hist.*, **73**: 281-329, pls. 2-7.

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GROUP G

46. CARPENTER, J. R., and FORD, J. 1936. The use of sweep net samples in an ecological survey. *J. Soc. Brit. Ent.*, **1**: 155-61.

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47B. ———— 1937. Idem.—Further observations. *Ibid.*, **1936-37**: 1-6, pls. 1-2.

GROUP H

48. HANITSCH, R. 1938. Die Arthropodenfauna von Madeira nach den Ergebnissen der Reise von Prof. Dr. O. Lundblad, Juli-August, 1935. vi. Blattaria. *Ark. Zool.*, **30B** (5): 1-2.

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52. EDELSTEN, H. M., and TAMS, W. H. T. 1938. The identity of *Acosmetia morrisii* Dale (in Morris). *Ibid.*, **71**: 160.

53. COOK, J. H. 1936. A contribution towards a study of *Calosoma inquisitor* L. (Coleopt., Carabidae). *Trans. Soc. Brit. Ent.*, **3**: 79-114, pls. 6-11.

54. HEINRICH, G. 1937. A list and some notes on the synonymy of the types of the subfamily Ichneumoninae Ashmead (Hymenoptera) in the collections of the British Museum and the Hope Department of the Oxford University Museum. *Ann. Mag. Nat. Hist.* (10), **20**: 257-79.

55. HOBBY, B. M. 1936. The Ethiopian species of the *fasciata* group of the genus *Bactria* (=*Promachus*) (Diptera, Asilidae). *Ent. Mon. Mag.*, **72**: 182-99, 231-49, 274-8.

56. CHAMBERLIN, J. C. 1938. New and little-known false scorpions from the Pacific and elsewhere (Arachnida—Chelonethida). *Ann. Mag. Nat. Hist.* (11), **2**: 259-85.

GROUP I

57. CARPENTER, G. D. H. 1935. [Review of] The Arachnida, by Theodore H. Savory. *Oxford Magazine*, Nov. 28, 1935: 233.

58. POULTON, E. B. 1938. Darwin misunderstood. [Review of 'Charles Darwin, the Fragmentary Man,' by Geoffrey West.] *Nature*, **141**: 807.

59. CARPENTER, G. D. H. 1937. [Review of] 'A catalogue of the African Hesperiidae indicating the classification and nomenclature adopted in the British Museum,' by Brigadier W. H. Evans. *Entomologist*, **70**: 213-5.

60. HOBBY, B. M. 1938. [Review of] 'Nature study above and below the surface. A bridge between amateur and professional.' By H. C. Gunton. *Quart. J. R. Met. Soc.*, **64**: 551-2.

61. ——— 1938. [Review of] 'The British Mosquitoes,' by J. F. Marshall. *Ent. Mon. Mag.*, **74**: 258-9.

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GROUP J

63. ——— 1935. Report of the Hope Professor of Zoology (Entomology) for the year ending 31 July, 1935. *Oxford Univ. Gaz.*, **66**: 203-8 (repaged 1-16).

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66. ——— 1938. Idem ending 31 July, 1938. *Ibid.*, **69**: 231-5 (repaged 1-13).

British Association for the Advancement of Science.

NOTTINGHAM: 1937

THE PRESIDENTIAL ADDRESS

THE HISTORY OF EVOLUTIONARY THOUGHT

AS RECORDED IN MEETINGS OF THE BRITISH ASSOCIATION

BY

PROF. SIR EDWARD B. POULTON, D.Sc., LL.D., F.R.S.

PRESIDENT OF THE ASSOCIATION.

SIR WILLIAM THOMSON, in his Address at Edinburgh in 1871, said that 'the real origin of the British Association' was given in the words of a letter written by David Brewster to John Phillips on February 23, 1831, a few months before the first meeting: 'The principal object of the Society would be to make the cultivators of science acquainted with each other, to stimulate one another to new exertions, and to bring the objects of science more before the public eye, and to take measures for advancing its interests and accelerating its progress.' That the time was fully ripe for the birth of the Association is made very clear by the words written by John Keble to a friend, referring to the D.C.L. degrees conferred, at the Oxford meeting in 1832, on David Brewster, Robert Brown, John Dalton and Michael Faraday: 'The Oxford Doctors have truckled sadly to the spirit of the times in receiving the hodge-podge of philosophers as they did'—an opinion on which Lord Salisbury commented at the Oxford meeting in 1894: 'It is amusing at this distance of time, to note the names of the hodge-podge of philosophers whose academical distinctions so sorely vexed Mr. Keble's gentle spirit.' It is not only amusing but pathetic that such words should have been used by a revered member of a University which had done

splendid service for science, as has been so well shown in Dr. R. T. Gunther's volumes.[1]

Faced by the serious duty of preparing this address, I felt that the best hope of interesting you would be to choose a subject which has received special attention at our meetings. I have selected the progress of thought on Organic Evolution as it may be followed in addresses, papers, and discussions, mainly restricting myself to the series of meetings which began with the Jubilee at York in 1881, the first of many that I have had the pleasure of attending.

The British Association provides a very favourable field for the discussion of many-sided subjects such as Evolution—subjects which attract members from very different as well as from closely related Sections. Hence a wide range of varied experience is open to one who can look back over more than half a century; and I do not propose to exclude some of the humorous sayings and incidents which, from time to time, have enlivened our meetings and contributed to their success. Some of them certainly deserve to be rescued from oblivion, although to perform this pious duty I must risk the enmity of the Goddess of Folly, who as Erasmus tells us, proclaimed: 'I hate a man who remembers what he hears.'

The Fiftieth Anniversary at York was a memorable meeting, with Sir John Lubbock (Lord Avebury) as President, and the Chair of every Section except Economics, under Grant Duff, taken by a Past-President of the Association.

I then enjoyed to the full one of the chief benefits conferred by our Association upon its younger members—the opportunity of meeting older men, up to that time only known to them by the fame of their discoveries. Prof. O. C. Marsh had come over from Yale, his main object being to buy for his University Museum the second and more perfect fossil of the wonderful ancestral bird Archæopteryx, with teeth and a long, lizard-like tail—clear evidence of Reptilian origin. The earlier example had been bought for the British Museum at a price which was said to have provided the dowry for a professor's daughter, and Marsh soon realised, as he told me, that the second was not for sale on any terms. 'We let the other go and I believe they would kill me if this were sold' was the reply given to him by the authority in Munich. He was, however, able to study the fossil, and his description and drawings of the teeth, in the Geological Section, followed the only attack on Evolution itself, as distinct from its causes, which I have ever witnessed at any of our meetings. It was the exhibition by H. G. Seeley of his reconstruction of Archæopteryx from this fossil,

[1] *Early Science in Oxford*, vols. i–xi.

which aroused the fury of the palæontologist, old Dr. Thomas Wright of Cheltenham: 'Archæopteryx hasn't got a head, how can it possibly have teeth?' he growled, knowing nothing of the latest find or of the fact that a detached head and scattered teeth had been detected on the slab in which the older specimen was embedded. In spite of Prof. Newton's positive statement and the form of the teeth, drawn by Prof. Marsh at the request of the Chairman, Dr. Wright, quite unconvinced, continued muttering 'Archæopteryx is a very good bird,' its virtue in his opinion entirely uncontaminated by any taint of Reptilian affinity.

Prof. Marsh also read a paper in the Zoological Section on his own wonderful discoveries of toothed birds from the rocks of the western United States. Richard Owen, President of the Section, was in the Chair and, with the memory of old and embittered controversies in his mind, the author told me that he had felt rather anxious in bringing this communication forward. But in that friendly atmosphere there was no reason for alarm. Owen welcomed the paper warmly and in confirmation told us, in the most charming manner, of the traces of teeth found in an embryo parrot.

The event which stands out most clearly in my memories of the Jubilee meeting is Huxley's evening lecture on 'The Rise and Progress of Palæontology'—the science which provides an essential part of the foundation on which Geographical, Geological and Biological evolutionary history has been built. The insuperable difficulty felt by the older naturalists was to believe that the land had been for the most part deposited under the sea, and to account for the presence of fossils, or as they were called, 'formed stones.' The true solution, Huxley explained, was found and published in 1669 by Nicholas Steno, a Danish Professor of Anatomy at Florence, who carefully studied certain fossils, known as 'glossopetræ,' which abounded in the Tuscan rocks and were believed to be fossil fig-leaves. Steno, who was not satisfied with this interpretation, dissected a shark's head and showed that the 'glossopetræ' exactly corresponded in every particular with the teeth—'that in fact they were shark's teeth.' The emphasis with which Huxley made this statement comes back to me after the lapse of nearly sixty years. From this Steno was led to conclude that they were the teeth of shark-like fishes living in the Tuscan sea and later embedded, with other remains, in the strata which had there accumulated.

I have not noticed the fanciful suggestion of 'fossil fig-leaves' in any published version or account of Huxley's lecture that I have seen, but he certainly told us of it and it is an interesting example of the attempts made by the naturalists of the day to explain the fossils embedded in rocks then believed to be of terrestrial origin. I

cannot resist the temptation of quoting Plot's[2] more ingenious and amusing effort to account for the well-known layer of oyster-shells (*Ostrea bellovacina*) found '. . . at some places here in *England*, particularly at *Cats-grove* [now Katesgrove] near Reading . . .; which how they should come here without a *Deluge*, seems a difficulty to most men not easily avoided.'

Plot was, however, helped 'to a *salvo*' for his own objection by remembering that Reading was 'a *Town* of very great *action* during the *Invasions* of the *Danes*, who cutting a deep trench cross between the *Kennet* and *Thames*, and inclosing themselves as it were in an *Island*, held it against King *Ethelred*, and *Alfred* his Brother a considerable time; from whence in all probability, the *Saxons* having removed their *Cattle* and other provisions before the *Danes* arrival, 'tis likely they they might be supplyed from their *Navy* with *Oysters*, which during the time of the aboad of the *Army* on Land, might be a very suitable employment for it: Which conjecture, if allowed, there is nothing more required to make out the possibility of the bed of *Oysters* coming thither without a *Deluge*, but that *Cats-grove* was the place appointed for the *Armies* repast.'

The probability of this suggestion may be inferred from the age of the 'Woolwich and Reading' beds in which the oysters are found—estimated by my friends Prof. Watts and Prof. Hawkins at about 50 to 60 million years.

Dr. Plot's explanation of fossils in general as well as of flowers was of a very different kind. To account for their existence he appealed to 'the wisdom and goodness of the *Supreme Nature*, by the *School-men* called *Naturans*, that governs and directs the *Natura naturata* here below, to beautifie the World with these varieties; which I take to be the end of such productions as well as of most *Flowers*, such as *Tulips*, *Anemones*, &c. of which we know as little use as of formed stones.'

The modest and withal amusing paragraph which follows I venture to quote in full as an example to be followed in scientific controversy:

'And thus I have given the grounds of my present *opinion*, which has not been taken up out of *humor* or *contradiction*, with intent only to affront other worthy Authors modest conjectures, but rather friendly to *excite them*, or any *others*, to endeavor collections of *shell-fish*, and parts of other *Animals*, that may answer such *formed stones* as are here already, or may hereafter be produced: Which when ever I find done, and the reasons alleged *solidly* answered, I

[2] *The Natural History of Oxfordshire, being an Essay toward the Natural History of England,* by Robert Plot, D.D. Printed at the Theater in Oxford. 1677. Dedicated To the most Sacred Majesty of Charles the Second, King of Great Britain, France and Ireland, Defender of the Faith, etc. (pp. 118–122).

shall be ready with acknowledgment to retract my *opinion*, which I am not so in love with, but for the sake of *Truth* I can chearfully cast off without the least reluctancy.'

One chief object which, as I believe, Huxley had before him was to bring forward a calm, clear statement of the evidence on which alone it was possible to achieve that 'reconstruction of an extinct animal from a tooth or bone,' which had made so deep an impression on the imagination. The reconstruction was in fact a simple inference based on anatomical experience such as that gained by Steno when he dissected the shark and concluded that the 'glossopetræ' were the teeth of shark-like fishes. But this reasoning—that a fossil tooth or bone on the surface of a rock, cannot by itself enable the geologist to predict that a skeleton of a certain type lies hidden beneath—seeming to diminish the glory of Cuvier's splendid work, was resented by Owen who had replied with the bitter taunt that a tooth can tell us a great deal—a donkey can kick his master but he cannot eat him. This may have been the encounter referred to by Huxley when he wrote of a friendly meeting with Owen at the Zoological Section of the Association in Leeds (1858): 'so that the people who had come in hopes of a row were (as I intended they should be) disappointed.'[3] In the same spirit, I think, Huxley was glad to speak of the 'glossopetræ' at the Jubilee meeting, where Owen was President of a Section, and calmly and simply, to reaffirm conclusions which are unassailable.

Huxley then passed on to Steno's further study of fossils and his proof of their relationship to terrestrial freshwater and marine organisms, and to his application of this evidence to the past condition of Tuscany—all discussed 'in a manner worthy of a modern geologist' and later extended by Buffon to all parts of the world then known to be fossiliferous. These conclusions, 'which almost constitute the framework of palæontology,' only required one addition, made towards the end of the eighteenth century by William Smith, who showed that geological strata contained characteristic fossils so that rocks of the same age could be identified in all parts of the world, while the biologist could follow the changes in the living population of the globe—a record of constant extinction and continual generation of new species. We were then led to three general conclusions: (1) the vast length of time during which life has existed on the earth—'certainly for millions of years'; (2) the continual changes which living forms have undergone during this period; (3) the successive changes in the best-known fossil groups are such as we should expect if each series 'had been produced by the gradual modification of the earliest form. . . .' This last conclusion meant evolution which so completely accorded with

[3] *Life and Letters*, vol. i, p. 157.

recent discoveries that 'if it had not existed, the palæontologist would have had to invent it.'

I can never forget the words spoken to me after the lecture by a dear friend of my youth, the late Viriamu Jones, Principal of University College, Cardiff: 'At every sentence I felt myself bowing to Huxley and saying "you are the greatest man here; no one else could have said that as you have said it."'

As Huxley's lecture continued in a calm spirit an embittered controversy, so his thoughts on the immensity of past geological and biological time lead naturally to another controversy on the age of the earth conducted intermittently at our meetings between 1892 and 1921. It is, I think, a good example of the invaluable help which the British Association brings to discussion when there appears to be a difficulty in reconciling the conclusions reached by the followers of different sciences. Lord Kelvin's estimate of a hundred million years as the period during which the earth had been cool enough to permit the existence of life upon its surface—a period reduced by Prof. Tait to ten million—was a great difficulty to geologists and biologists who believed that an immensely longer time was required for the history of the fossiliferous rocks and the evolution of animals and plants. Thus, to quote only one instance, Darwin writing to Wallace in 1871 and referring to 'missing links,' said, 'I should rely much on pre-Silurian time; but then comes Sir William Thomson, like an odious spectre.' The geologists resisted more firmly. Thus Sir Archibald Geikie, in his Presidential Address at Edinburgh in 1892, concluded his discussion of the subject with these words: 'The geological record furnishes a mass of evidence which no arguments drawn from other departments of Nature can explain away, and which, it seems to me, cannot be satisfactorily interpreted save with an allowance of time much beyond the narrow limits which recent physical speculation would concede.' At the Leeds meeting in 1890 I had many opportunities of meeting Prof. John Perry, and when we were walking together on the Sunday afternoon I asked him to tell me something of the Kelvin-Tait conclusions and how far they must be accepted. He had been a demonstrator under Kelvin and spoke of the intense interest with which he had followed his lectures at Glasgow, and he gave me no hope of escape. His change of opinion, throwing a most interesting light upon the influence of the British Association, was the result of the Presidential address at Oxford in 1894, when Lord Salisbury chaffed the believers in natural selection, telling them that he did not wonder that they required many hundred million years for so slow a process, but that 'if the mathematicians are right, the biologists cannot have what they demand. . . . The jelly-fish would have

been dissipated in steam long before he had had a chance of displaying the advantageous variation which was to make him the ancestor of the human race.' When Perry read this pronouncement, sweeping aside the firm convictions of biologists and geologists, he was led to re-examine the evidence and soon found a flaw. The heat of the earth had been calculated on the assumption of a conductivity uniform through the whole mass, but Perry showed that with a conductivity becoming higher with increasing depth the Kelvin-Tait estimate of the time required for cooling to the existing temperature—on which the age of the habitable earth had been based—must be immensely lengthened. Perry told me of this destructive criticism and very kindly helped me to make use of it in the address to Section D at Liverpool in which I replied to Lord Salisbury's amusing attack on the evolutionists.

Lord Lister was our President at Liverpool in 1896, and I cannot resist the temptation to digress for a moment and recall the address in which one of the greatest benefactors of mankind told us, with the utmost simplicity and modesty, the story of his life's work and the success which, in spite of all opposition, had been achieved. To hear him was an enduring inspiration.

The year 1896 was also the Jubilee of Lord Kelvin's wonderful half-century of achievement in research and teaching, and I could not help feeling some regret that any criticism of his work should appear at this particular time. But in the kindly spirit of our Association such doubts were quite unnecessary. I well remember how he came one day to our Sectional Committee-room to bring me some volumes of his works, and how, as I have recorded before, in the following year as we were travelling across Canada after the Toronto Meeting and the chance of collecting insects for a few minutes at each station could not be resisted, Lord Kelvin said to his wife, 'My dear, I think we must forgive Poulton for thinking that the earth is so very old when he works so hard in one day out of all the endless millions of years in which he believes!' [4]

The one line of evidence which left some anxiety in 1896, was suggested by Helmholtz who allowed the sun only eighteen million years to have been giving out radiant heat at the present rate—a period Lord Kelvin was willing to extend to 500 million—and this estimated maximum was also accepted by Sir George Darwin, who, in his address [5] at Cape Town in 1905, spoke of the new evidence obtained by M. and Mme. Curie in their proof that radium gives out heat, and quoting in confirmation the work of R. J. Strutt, W. E. Wilson, and G. H. Darwin, finally concluded that 'the physical argument is not susceptible of a greater degree of certainty

[4] *Report, British Association, Centenary Meeting,* 1931, p. 78.
[5] *Report, British Association,* 1905, pp. 514–518.

than that of the geologists, and the scale of geological time remains in great measure unknown.' The light thrown by radium upon the Helmholtz estimate was also referred to in the Presidential Address of Ray Lankester at York in 1906, of J. J. Thomson, quoting the work of Strutt, Joly and Rutherford, at Winnipeg in 1909, and became a predominant subject in the Joint Discussion on the Age of the Earth, between Sections A, C, D and K, at Edinburgh in 1921.[6] Lord Rayleigh in opening this discussion concluded 'that radioactive methods of estimation indicate a moderate multiple of 1,000 million years as the possible and probable duration of the earth's crust as suitable for the habitation of living beings. . . .'

Even in the present year Sir Ambrose Fleming, in his address to the Victoria Institute, is reported in *The Times* of January 12 to have maintained that 'We were not in possession of any generally agreed scientific modes of geological time measurement, but only with estimates which were based for the most part on personal predilection or guesses at truth.' It is to be regretted that the conclusions of scientific colleagues should be attributed to 'personal predilection,' and as for 'guesses at truth '—what are these but hypotheses ; and surely the discoverer whose imaginative effort led to the thermionic valve and did so much to endow the world with the infinite possibilities of wireless—surely he has little cause to choose for the serious efforts of others the word which in this connection carries a suggestion of shallow irresponsibility.

Geologists and biologists do not profess to know the age of the earth as the abode of life, but they are sure that, in the words used by Sir William Turner at Bradford in 1900, its birth 'must have been in the far-distant past, at a period so remote from the present that the mind fails to grasp the duration of the interval.'

I fear that too much of our time has been occupied by the attempt to show that the field is clear for the discussion of Organic Evolution, but until this could be done any such discussion appeared to be well-nigh useless.

It is, I think, a mistake to emphasise too strongly the very natural shock received by many who read the *Origin* or heard of its teaching for the first time and without any preparation ; and I believe an even greater mistake to criticise the clergy for the time that elapsed before their acceptance of the new teaching. I shall never forget the reception of Aubrey Moore's paper, 'Recent Advances in Natural Science in their Relation to the Christian Faith,' by the Church Congress at Reading in 1883.[7] No speaker could have carried his audience with him more thoroughly : there was not a single protest or indication of dissent—nothing but enthusiastic

[6] *Report, British Association,* 1921, pp. 413–415.
[7] *Science and the Faith,* London, 1889, pp. 222–235.

applause. The Bishop of Oxford, Dr. Mackarness, was in the chair when the paper received this unanimous welcome—only twenty-three years after the Oxford meeting at which another Bishop of Oxford put his rude and foolish question to Huxley. It is pleasant to know that their celebrated encounter left no bitterness, for Huxley wrote in 1891 to Francis Darwin—' In justice to the Bishop, I am bound to say that he bore no malice, but was always courtesy itself when we occasionally met in after years.'

I remember as a youth receiving a gentle parental warning against committing myself too entirely to a belief in evolution—a very different experience from that of our President at Hull in 1922, my friend Sir Charles Sherrington, who in 1873 was persuaded by his mother to take the *Origin* with him on his summer holiday, with the inspiring words—' It sets the door of the Universe ajar ! '

I have already recalled Dr. Wright's indignation at York in 1881 as my only experience of opposition to a belief in Organic Evolution at any of our meetings, and the published Proceedings confirm this impression of unanimity. Thus, R. H. Traquair, addressing the biologists at Bradford in 1900, said, ' I hardly think that we should now find a single scientific worker who continues to hold on to the old special creation idea ' ; and Lord Salisbury at Oxford in 1894, referring to Darwin, said, ' He has, as a matter of fact, disposed of the doctrine of the immutability of species. It has been mainly associated in recent days with the honoured name of Agassiz, but with him has disappeared the last defender of it who could claim the attention of the world.' The mention of this great American naturalist recalls Tyndall's fine address at Belfast in 1874 and his memories of Agassiz's words, ' I was not prepared to see this theory received as it has been by the best intellects of our time. Its success is greater than I could have thought possible.'

Huxley, who had seconded the vote of thanks to Lord Salisbury, wrote to Hooker a few days later : ' It was very queer to sit there and hear the doctrines you and I were damned for advocating thirty-four years ago at Oxford, enunciated as matters of course—disputed by no reasonable man !—in the Sheldonian Theatre by the Chancellor. . . .' [8]

A letter written two days earlier to Boyd Dawkins records Huxley's opinion of another part of the address. ' Lord Salisbury gave himself away wonderfully, but he was so good about Darwin himself that I shut my eyes to all the nonsense he talked about Natural Selection.' [9]

[8] *Life and Letters*, 1900, vol. ii, p. 379.

[9] From a letter of August 10, 1894, printed in the *Jesus College* (*Oxford*) *Magazine*, for Lent Term, 1928 ; and reprinted in *Hope Reports*, vol. xvi, 1929, no. 3, p. 6. (Privately circulated to many scientific libraries.) Huxley's letter of August 18, 1894, to Lewis Campbell (*Life and Letters*, vol. ii, p. 379) refers to the same subject.

Leaving now the subject of Organic Evolution itself, as generally accepted, I wish to speak on the difficult question of its motive causes which for many years have formed the subject of addresses, discussions and papers at our meetings. The great division into two opposed theories of causation became clear in 1887 when Weismann attended the meeting at Manchester, and a discussion on 'The Hereditary Transmission of Acquired Characters' was held in Section D. From that time evolutionists attending our meetings have been either 'Lamarckians,' following Erasmus Darwin, Lamarck, Buffon and Herbert Spencer, or 'Darwinians' who followed Darwin and Wallace. Darwin himself, however, included the Lamarckian conception of 'use-inheritance' as a motive cause, although believing it to be far less important than Natural Selection. The term 'Neo-Darwinian' has therefore been applied to those who, accepting Weismann's teaching, reject 'use-inheritance' altogether.

It must always be remembered that, apart from any theory of causes, the world owes its belief in organic evolution to all the great men whose researches and teaching have founded the two schools, and perhaps chiefly, at any rate among the English-speaking nations, to Herbert Spencer. I was first led to realise the extent of his transatlantic popularity when I learned from an American story greatly enjoyed in those far-off undergraduate days, that his books were keenly appreciated by a bashful hero, who was so far from sharing the sublime confidence of their author, that he was only led to perform the most fateful action in life by the pressing advice of a very young nephew who assured him, in the presence of the lady, that if he was fond of her, the proper thing to do was to kiss her. Herbert Spencer's infallibility certainly lent itself to such stories as that of his supposed reply to an argument—'That can't be true, for otherwise *First Principles* would have to be re-written—and the edition is stereotyped'; or how Darwin said that to read Spencer always made him feel like a worm, but that he retained the worm's privilege of wriggling, and at another time 'wonderfully clever, and I dare say mostly true.' But, allowing for a style which provoked these and other amusing comments, we must never forget that believers in the doctrine of Organic Evolution owe an immeasurable debt to Herbert Spencer.

James Russell Lowell's amusing lines in the *Biglow Papers*[10] appear to prove that Lamarckism was prevalent in America many years before the *Origin*:

> 'Some flossifers think thet a fakkilty's granted
> The minnit its proved to be thoroughly wanted,
>
> . . . . .

[10] The lines are quoted from the First Part, published 1846–48.

Ez, fer instance, thet rubber-trees fust begun bearin'
Wen p'litikkle conshunces come into wearin',—
Thet the fears of a monkey, whose holt chanced to fail,
Drawed the vertibry out to a prehensile tail.'

The year of the Manchester meeting, 1887, was the fiftieth anniversary, and we are now celebrating the Centenary, of the entry in Darwin's pocket-book:

'In July opened first note-book on Transmutation of Species. Had been greatly struck from about the month of previous March on character of South American fossils, and species on Galapagos Archipelago. These facts (especially latter), origin of all my views.'

It is especially interesting to recall that these views, as Professor Newton told us in his address to D, the Biological Section, did not include Natural Selection which only came into Darwin's mind when he read Malthus, *On Population*, in October, 1838. Newton, who had read the proof-sheets of the great *Life of Darwin*, published later in 1887, then spoke of Wallace's independent discovery, made twenty years after Darwin's, a discovery suggested to him also by reflecting on Malthus, and of the friendship between the two great men to whom this fruitful conception had come, referring the cynic who would 'point the finger of scorn at the petty quarrels in which naturalists unfortunately at times engage' to this 'greatest of all cases, where scientific rivalry not only did not interfere with, but even strengthened, the good-feeling which existed between two of the most original investigators.' And here I cannot resist the desire to quote a part of the speech made by Wallace at the most thrilling scientific gathering I have ever attended—the fiftieth anniversary of the Darwin-Wallace Essay read before the Linnean Society on July 1, 1858, only twelve days after the arrival of Wallace's letter and manuscript from the Moluccas. Wallace then said, on July 1, 1908:

'The idea came to me, as it had come to Darwin, in a sudden flash of insight: it was thought out in a few hours . . . and sent off to Darwin—all within one week. *I* was then (as often since) the "young man in a hurry": *he*, the painstaking and patient student, seeking ever the full demonstration of the truth that he had discovered, rather than to achieve immediate personal fame. . . . If the persuasion of his friends had prevailed with him, and he had published his theory, after ten years'—fifteen years'—or even eighteen years' elaboration of it—*I* should have had no part in it whatever, and *he* would have been at once recognised, and should be ever recognised, as the sole and undisputed discoverer and patient investigator of the great law of "Natural Selection," in all its far-reaching consequences.' [11]

[11] *Darwin-Wallace Celebration of the Linnean Society of London*, 1908, pp. 6, 7

Amusing evidence of the difficulty with which this 'great law' was understood is afforded by a verse written by Lord Neaves and dated May, 1861 :

> 'A deer with a neck that was longer by half
> Than the rest of its family's (try not to laugh),
> By stretching and stretching, became a Giraffe,
> Which nobody can deny.' [12]

Yet Wallace, referring to Lamarck's hypothesis and 'that now advanced,' had written in his Section of the Joint Essay :

'Neither did the giraffe acquire its long neck by desiring to reach the foliage of the more lofty shrubs, and constantly stretching its neck for the purpose, but because any varieties which occurred among its antitypes with a longer neck than usual *at once secured a fresh range of pasture over the same ground as their shorter-necked companions, and on the first scarcity of food were thereby enabled to outlive them.*'

There were fortunately others who did not launch such ill-aimed criticism. Thus Professor Newton, reminding the Section that the new teachings had been at once accepted by Canon Tristram [13] before the appearance of the *Origin of Species* (on November 24, 1859), expressed, with all the enthusiasm of one who was devoted to the same delightful branch of natural history, 'the hope that the study of ornithology may be said to have been lifted above its fellows.' It was indeed very fortunate that the Darwin-Wallace Essay should have been read so soon after its appearance by a naturalist who looked on the species question as did Tristram—a great traveller and observer who studied indefatigably the birds he loved, as living creatures and in as many countries as he could visit.

At the last meeting of the British Association in Nottingham (1893) Canon Tristram was President of Section D and, in his address, gave an account of the observations referred to by Newton at Manchester. The historic interest of this early acceptance of Natural Selection is such that I have prepared a brief abstract of his chief conclusions :

During a visit of many months to the Algerian Sahara in 1857–58, he 'noticed the remarkable variations in different groups, according to elevation from the sea, and the difference of soil and vegetation.' On his return he read the Darwin-Wallace Essay and wrote, 'It is hardly possible, I should think, to illustrate this theory better than by the larks and chats of North Africa.' He then explained how the colours arose by selective destruction of birds which harmonized less well than others with the surface of the desert. And similarly with other larks having 'differences, not only of colour, but of

[12] *The Origin of Species. A new song.* In *Songs and verses, social and scientific, by an old contributor to Maga. Edinburgh, 1868, 2 Ed.*

[13] *Ibis*, October, 1859, pp 429–433.

structure,' chiefly 'marked in the form of the bill.' He took as instances a very long-billed lark (*Galerita arenicola*), resorting exclusively to the deep, loose, sandy tracts, and a very short-billed allied species (*G. isabellina*), haunting the hard and rocky districts. He then pointed out that there is individual variation in the bills of larks and that the shorter-billed birds would be at a disadvantage in obtaining food from sandy areas but at an advantage among the rocks where strength is required. He concluded, 'Here are only two causes enumerated which might serve to create, as it were, a new species from an old one. Yet they are perfectly natural causes, and such as I think must have occurred, and are possibly occurring still. We know so very little of the causes which in the majority of cases, make species rare or common that there may be hundreds of others at work, some even more powerful than these, which go to perpetuate and eliminate certain forms "according to natural means of selection."'

The temptation to record an amusing incident which happened at one of the meetings of Section D at Manchester, cannot be resisted. Work was proceeding smoothly under the genial guidance of Prof. Newton when, suddenly, Dr. Samuel Haughton of Dublin entered and from the back of the room announced in arresting tones that he had an important communication to make about the animals preserved from the Flood. He believed that Mrs. Noah strongly objected to her husband's intention to take the elephants on board, fearing that their weight would cause a dangerous displacement of the Ark's metacentre. How this domestic difference was composed we had no opportunity of learning, for as the Chairman, whose expression combined sympathetic amusement with mild deprecation, was rising and about to protest, Dr. Haughton, anticipating the result, had already turned towards the door, telling us over his shoulder that he was on his way to make a fuller communication on the subject to the Anthropological Section.

After this brief description of an event, which I hope you will agree ought not to be forgotten, we must return to Organic Evolution and to one of the most important subjects debated at any time before a meeting of the British Association—the question, "Are Acquired Characters Hereditary?"—brought before the world by Prof. August Weismann, who was present at Manchester and spoke in the discussion (unfortunately not reported), introduced by Ray Lankester, in which Dr. Hubrecht, Patrick Geddes, Marcus Hartog and the present speaker, took part. Weismann's conclusion that 'Acquired Characters' are not inherited, was held by Prof. Goodrich, in his address to Section D at Edinburgh in 1921, to be 'the most important

contribution to the science of evolution since the publication of Darwin's *Origin of Species*,' an opinion with which the great majority of biologists will agree, although the terms employed for the two classes, the Inherited and the Non-inherited, together with the ideas underlying them, were shown by Adam Sedgwick, at Dover in 1899, Archdall Reid, and others, as well as by Goodrich himself, to be incorrect. Nevertheless it will probably be impossible to abandon the word ' acquired,' employed by Erasmus Darwin (1794), Lamarck (1809), and Prichard (1813) as well as by later authorities. Whenever environmental conditions are followed by characteristic changes, absent when these conditions are absent ; or when such changes follow the use or disuse of the parts of an organism, or the education it has received, then we have before us the ' acquired ' characters maintained by Weismann to be incapable of hereditary transmission. This vital conclusion, accepted, as I believe it is, by nearly all biologists, is not appreciated as it ought to be by the general public. A brief statement of a single piece of evidence may convince some who are doubtful about a conclusion with which human life is very deeply concerned.

My old friend the late A. A. Macdonell, Professor of Sanskrit at Oxford, spoke two languages, English and German, as they are spoken by native Englishmen and Germans. I asked him whether he thought it was possible for any mature person to learn a foreign language so perfectly that he would be mistaken for a native. He replied that he was sure it could not be done and that his own ability to speak the two languages as he did had been only made possible because as a small child he had been continually taken backwards and forwards between the two countries. Yet any human being transported as a baby from his own country to another and brought up there among the natives will learn to speak as they speak. All the past generations, however many, during which his ancestors spoke the language af his birthplace, will count for nothing, will not retard his acquisition of another tongue or modify it in any way.

An interesting and amusing example is provided by the futile striving of an Englishman to pronounce the Welsh double-l, generally attempted by the substitution of ' th.' And even the advice given by a Welsh clergyman to the English Bishop of his diocese is unlikely to bring success : ' You must put the tip of your Right Reverend tongue against the roof of your Right Reverend mouth, and hiss like a goose.'

The result of education as an ' acquired ' character in the Weismannian sense is of such special importance that I think it is well to quote the conclusions stated by Ray Lankester in his address to the seventy-fifth meeting of the Association at York. He then maintained that the ' power of building up appropriate cerebral mechanism

in response to individual experience, or what may be called " educability," is the quality which characterises the larger cerebrum, and is that which has led to its selection, survival, and further increase in volume' . . . '" Educability " can be transmitted; it is a congenital character. But the *results* of education can *not* be transmitted. In each generation they have to be acquired afresh. . . . On the other hand, the nerve-mechanisms of instinct are transmitted, and owe their inferiority as compared with the results of education to the very fact that they are *not* acquired by the individual in relation to his particular needs, but have arisen by selection of congenital variation in a long series of preceding generations.' [14]

Lankester was led by these conclusions to reject altogether the theory of G. H. Lewes, G. Romanes, and others, ' that instincts are due to lapsed intelligence,' a theory also disproved by Lloyd Morgan's observations on young birds described by him at the Ipswich meeting in 1895.[15] Another very important subject brought forward by Lankester was the evidence, originally published by him in 1894,[16] that Lamarck's first and second laws of heredity ' are contradictory the one of the other, and therefore may be dismissed.' His statement may be briefly summarised as follows:

The first law assumes that in spite of thousands of generations during which a normal environment has ' moulded the individuals of a given species of organism, and determined as each individual developed and grew " responsive " quantities in its parts (characters); yet, as Lamarck tells us, and as we know, there is in every individual born a potentiality which has *not* been extinguished. Change the normal conditions . . . and (as Lamarck bids us observe), in spite of all the long-continued response to the earlier normal specific conditions, the innate congenital potentiality shows itself. The individual . . . shows *new* responsive quantities in those parts of its structure concerned, new or acquired characters.'

' So far, so good. What Lamarck next asks us to accept, as his " second law," seems not only to lack the support of experimental proof, but to be inconsistent with what had just preceded it. The new character which is *ex hypothesi*, as was the old character . . . which it has replaced—a response to environment . . . is, according to Lamarck, all of a sudden raised to extraordinary powers. The new or freshly acquired character is declared . . . to be capable of transmission by generation; that is to say, it alters the potential character of the species. It is no longer a merely responsive

[14] *Report, British Association*, 1906, pp. 26–27. The conclusions here quoted had been communicated to *Société de Biologie* of Paris, in 1899 (Jubilee Volume) and were reprinted in *Nature*, vol. lxi, 1900, pp. 624–625.

[15] *Report, British Association*, p. 734.

[16] *Nature*, vol. li, 1894, p. 127; *Report, British Association*, 1906, pp. 29, 30.

or reactive character, determined quantitatively by quantitative conditions of the environment, but becomes fixed and incorporated in the potential of the race, so as to persist when other quantitative external conditions are substituted for those which originally determined it.'

The effect of Lamarck's laws on the hereditary transmission of acquired characters would be this: 'a past of indefinite duration is powerless to control the present, while the brief history of the present can readily control the future.'

After hearing a very condensed statement of conclusions so essentially bound up with the progress of Organic Evolution, I feel sure that you will wish to be reminded of Prof. Ewing's words which followed the address at York:

'Now is the winter of our discontent made glorious summer by this Ray of Lankester.'

Returning to the unreported discussion on the inheritance of acquired characters at Manchester, I venture to bring forward certain observations opposed to a belief in Lamarckian evolution by means of inherited experience—observations which I then described and have not known to be answered. In the relationship between enemy and prey there is very commonly no opportunity for the latter to learn by experience. The wonderfully elaborate adaptations by which sedentary insects are hidden from enemies have been evolved, not by experience of enemies but by avoidance of enemies. In these examples, and they are numberless, we are driven to accept Weismann's conclusion and with him to invoke 'the all-sufficiency of Natural Selection.' When one of the twig-like caterpillars, of which there are so many in this country, is detected by an insectivorous bird it can do nothing and is devoured at once. Its one defence is the astonishingly perfect resemblance to a twig of the bush or tree on which it lives. It is firmly fixed and its weight also supported by an almost invisible thread so that it cannot escape as many caterpillars do by dropping to the ground and sheltering in the grass or among dead leaves. Its one chance of survival is to gain so perfect a disguise that it will not be seen, and to gain this end the adaptive devices are most elaborate and wonderful: its twig-like shape and colours with the power of gradually adjusting these so as to resemble the bark of the bush or tree on which the parent moth laid the egg from which it came, even the power to reproduce exactly the appearance of lichen, the rigid stick-like attitude maintained during the hours of daylight. Finally there is the evidence, recently obtained by Robert Carrick,[17] that the disguise *does* protect; for examples of one of these caterpillars, resting on

[17] *Trans. Roy. Ent. Soc., Lond.*, vol. 85, part 4 (May 1936), p. 131, 3 pls.

a branch of its food-plant fixed over a wren's nest containing young, were unnoticed by the parent bird which used the same branch as a convenient perch ; yet seen and at once taken when placed on a white surface below.

One of the best examples of a prophetic instinct is to be found in the larva of an African Tabanid fly (*T. biguttatus*). This maggot lives and feeds in soft mud which, during the dry season when the chrysalis stage has been reached, will be traversed in all directions by wide and deep cracks in which insectivorous animals can search for prey. But the maggot, while the mud is still soft, prepares for this danger. By tunnelling spirally up and down it makes a line of weakness which will cause a pillar to separate from the mass when the mud hardens and contracts. It then tunnels into the still soft pillar and becomes a chrysalis in the centre of its deeper end. However wide the cracks which appear in the mud, the maggot has arranged beforehand that they will not invade its cylinder. Dr. W. A. Lamborn, who made this most interesting discovery, observed that the summits of the pillars, forming circular discs of about the size of a penny, scattered here and there over the surface, were never thus traversed, but that an empty shell was protruding from the centre of each when the fly had emerged.[18] My friend the late Prof. J. M. Baldwin, the distinguished American psychologist, well remembered at many of our meetings, wrote when he heard of this discovery : 'it seems *complete*—one of those rare cases of a single experience being sufficient to establish both a fact and a reason for the fact ! It is beautiful.'

I would ask any believer in Lamarckian evolution, or in Hering's and Samuel Butler's theory of unconscious memory residing in the germ-cells, how it would be possible to explain these prophetic instincts, adapted not to meet but to avoid future experience, except by the operation of natural selection.

The appeal to Orthogenesis, or internal developmental force, as the motive cause of evolutionary progress has often been made—generally by palæontologists rather than by the observers of living forms. Any such belief in the potency of an internal tendency is, I think, open to the criticism made by Thiselton Dyer in his address to Section D at Bath in 1888 : 'This appears to me much as if we explained the movement of a train from London to Bath by attributing to it a tendency to locomotion. Mr. Darwin lifted the whole matter out of the field of mere transcendental speculation by the theory of natural selection, a perfectly intelligible mechanism by which the result might be brought about. Science will always

[18] *Proc. Roy. Soc.*, B, vol. 106, 1930, p. 83, pl. v ; *Proc. Ent. Soc. Lond.*, vol. v, 1930, p. 14.

prefer a material *modus operandi* to anything so vague as the action of a tendency.'

It is not necessary for me to speak on the rediscovery of Mendel's great work and all that it has meant to our Biological Sections in the early decades of the present century. The recent developments, following the work of Haldane, R. A. Fisher, and others, and the vitally important relationship between Mendelism and Natural Selection were brought before us last year in Julian Huxley's illuminating address to Section D. The older belief that only large variations, or mutations as they then began to be called, were subject to Mendelian inheritance, and that small variations were not inherited at all, disappeared when further researches proved that extremely minute differences were 'heritable in the normal Mendelian manner,' [19] and, with this, the foundation of Darwinian evolution became immensely strengthened. It is also right to remember that Bateson, the leader of Mendelian research in this country, always believed in Natural Selection, regarding it indeed as self-evident and not very interesting. Also that Ray Lankester, as long ago as his 1906 address at York, maintained that however far Mendelism was advanced it 'would not be subversive of Mr. Darwin's generalisations, but probably tend to the more ready application of them to the explanation of many difficult cases of the structure and distribution of organisms.'

The relationship between the germinal foundation of Mendelian and Weismannian heredity was considered in a paper by L. Doncaster read before Section D at the South African meeting in 1905. He then maintained that Weismann's 'hypothesis that the material bearer of hereditary qualities is the chromatin of the nucleus' of the germ-cells had been confirmed by recent work on their maturation which 'has shown that they contain a mechanism which seems precisely adapted to bring about that segregation of characters which forms the most fundamental part of the Mendelian theory, and it seems hardly possible that the two things are unconnected.' MacBride also in his address to the same section at Newcastle in 1906, spoke of the 'great epoch-making discovery of experimental embryology, viz. the existence of SPECIFIC ORGAN-FORMING SUBSTANCES.' These fundamental discoveries bring to mind a conversation with Weismann when he had been finally driven to frame and elaborate this hypothesis, and was so appalled by the number and minuteness of the material bearers of hereditary qualities contained in a single germ-cell that, as he told me, he could not believe that the physicists and chemists were correct in their conclusions about the size of the atom. He admitted that diverse lines of evidence led to

[19] *Report, British Association*, 1931, p. 77 and references quoted.

the same result, but even so, he believed the future would prove that physicists were mistaken and that the atom was far smaller.

It is impossible to say more than a few words about the very interesting and important discussion on ' The present state of the Theory of Natural Selection ' held at the Royal Society on May 14 last year. The subject was approached from many points of view by both zoologists and botanists, and their conclusions were very welcome to Darwinians who remembered the earlier opinions expressed when Mendel's great work was rediscovered. I think, however, that Prof. D. M. S. Watson, in the opening address, was inclined to underestimate the value of the existing evidence for a ' selective death rate,' although everyone will agree that ' any new evidence . . . or indeed any suggestion of cases which might be capable of investigation,' would be most desirable.

I may briefly mention a few experiments brought before Section D at the Bristol meeting in 1898 beginning with the work of Weldon and Thompson on the Common Shore Crab, showing that the effect of china clay and other impurities in the sea at Plymouth was selective and promoted changes of shape which ensured that the water flowing over the respiratory surface was more efficiently filtered.

Then, on the subject of chance, the heroic help rendered by Mrs. Weldon, who four times recorded the result of 4,096 throws of dice, showing that the faces with more than three points were on the average, uppermost slightly more often than was to be expected. It comes back to me very clearly because of the interesting explanation—that the points on dice are marked by little holes scooped out of the faces, and that points 6, 5, and 4, respectively opposite 1, 2, and 3 are somewhat lighter, more of the ivory having been removed; also because of Francis Galton's delight and his humorously expressed wonder whether the facts had been realised by those who had an interest other than scientific in the throwing of dice.

Experimental evidence was also submitted by Miss Cora B. Sanders (Mrs. C. B. S. Hodson) and myself, proving that when the rough, angular pupa of the small tortoiseshell butterfly ' is suspended from a surface against which it stands out conspicuously, it is in far greater danger than when it is fixed to one upon which it is concealed.'

To the observer of living creatures, however, the most convincing evidence is provided by animals themselves. When a wild bird is seen to capture some conspicuous butterfly or moth and then immediately to reject it the association between inedibility and a warning colour is more convincingly suggested than when insects are offered to animals in confinement, although such experiments

distance beyond the tip of *R* 1; and in the tibial spurs, that of the front tibia being extremely short and the longer spur of the hind tibia apparently without any tooth."

Spaniotoma (*Orthocladius*) *mixtus* Holmgr. (?). **9,** 14. vi. 36, two females on snow and rock: **24,** 30. vi. 36, male.

Edwards wrote: "The male agrees with specimens I recorded doubtfully as *O. mixtus* in 1935 [Ann. & Mag. Nat. Hist. (10) xv. pp. 472 & 538] from Bear Island and East Greenland. The form is doubtfully distinct from *O. grampiana* Edw. of Scotland, differing chiefly in having the tip of the antennæ somewhat swollen and *A.R.* only about 1·0 instead of 1·2."

Spaniotoma (*Smittia*) *extrema* Holmgr. **1,** 12. vi. 36, female, in *Loiseleuria procumbens*: **15,** 13. vi. 36, two males, near *Loiseleuria procumbens*.

Spaniotoma (*Smittia*) sp. indet. **16,** 12. vi. 36, three males, abundant.

Mycetophilidæ.

Sciara tridentata Ribs. ?. **26,** 11. vii. 36, female.

Sciara sp. indet. **32,** 30. vii. 36, female (*P. B. Chambers*).

Simuliidæ.

Simulium (*Prosimulium*) *ursinum* Edw. **1,** 10. ix. 35, female; also two females found in sheltered pools of running water, Kangerdlugsuak, 29. viii. 35.

Brachycera.

Empididæ.

Rhamphomyia hirtula Zett. **16,** 12. vi. 36, three males and four females; abundant.

Cyclorrhapha.

Aschiza.

Syrphidæ.

Syrphus nigroventris Fluke. **19,** 12. vii. 36, female: **22,** 27. vi. 36, five males, abundant: **24,** 30. vi. 36, female: **27,** 10. vii. 36, female.

Syrphus sp. near *luniger* Mg. and *perplexus* Osb. **25,** 29. vi. 36, female.

Syrphus sp. near *tarsatus* Zett. **20,** 26. vi. 36, female, abundant.

Syrphus ? *nigropilosus* Curran. **20,** 28. vi. 36, female: **28,** 16. vii. 36, female.

ACALYPTRÆ.

Cordyluridæ.

Scatophaga lanata Ldbk. **11,** c. 1. vi. 36, two females: **14,** 17. vi. 36, female: **17,** 11. vi. 36, male: **20,** 5. vii. 36, male: **22,** 27. vi. 36, female, abundant.

Scatophaga furcata Say (= *squalida* Mg. = *varipes* Holmgr.). **1,** 17. vii. 36, two females; 20. vii., twenty-three males and two females, abundant; 4. viii., one male: **22,** 27. vi. 36, female.

Helomyzidæ.

Leria septentrionalis Coll. **1,** 17. vii. 36, three males, two females, common.

Anthomyidæ.

Pogonomyia sp. **16,** 12. vi. 36, female, abundant.

Limnophora (*Spilogona*) *arctica* Zett. **9,** 14. vi. 36, one male, one female: **28,** 16. vii. 36, female.

Limnophora ? *hyperborea* Boh. **16,** 12. vi. 36, female.

Pegomyia hæmorrhoa Zett. **1,** 18. xi. 35, male found dead on snow: **4,** 11. vi. 36, male: **11,** c. 1. vi. 36, male: **14,** 17. vi. 36, two males, one female: **16,** 10. vi. 36, two males: **26,** 11. vii. 36, female.

Acroptena frontata Zett. **1,** 19. ix. 35, male and female; 17. x. 35, male; 27. v. 36, female: 3. vi. 36, female: **9,** 14. vi. 36, female: **11,** c. 1. vi. 36, three females: **14,** 17. vi. 36, female: **16,** 10. vi. 36, female: **18,** 8. vii. 36, female: **22,** 27. vi. 36, two females, abundant.

Paregle radicum L. **1,** 17. vii. 36, female: 20. vii., thirteen females, abundant; 4. viii., female.

Egle sp. of *parva*-group. **14,** 17. vi. 36, two females: **20,** 26. vi. 36, female, abundant: **24,** 30. vi. 36, female.

Delia echinata Seguy. **9,** 14. vi. 36, one male, one female : **11,** 1. vi. 36, male : **28,** 14. vii. 36, female.

Tachinidæ.

Peleteria ænea Zett. **29,** 25. vii. 36, male (*P. B. Chambers*).

Peteina stylata B. B. **4,** 11. vi. 36, male : **9,** 14. vi. 36, male : **15,** 13. vi. 36, male : **16,** 10. vi. 36, female.

Phormia groenlandica Zett. **1,** 8. vii. 36, female ; 17. vii. 36, female.

Phormia atriceps Zett. **1,** 17. vii. 36, one male, one female ; 20. vii., female : **14,** 17. vi. 36, female : **22,** 27. vi. 36, female : **24,** 30. vi. 36, female.

Cynomyia mortuorum L. **1,** 16. vii. 36, two females ; 17. vii., three males, seven females : **20,** 5. vii. 36, female : **25,** 29. vi. 36, female : **28,** 16. vii. 36, female.

Calliphora uralensis Vill. **1,** 17. vii., female.

PART II.—ARANEÆ. By AKE HOLM.

The following species of spiders were collected by the English Expedition to East Greenland (1935–6) in Kangerdlugsuak, Knud Rasmussen Land: the collector was P. B. Chambers. The material having been preserved dry many specimens were in bad condition, but by making them soft in water and transferring them into 80 per cent. alcohol the determination has been possible.

Ten species are represented in the collection, and two of them have been recorded as new to Greenland and the Nearctic area, viz., *Caledonia evansii* (Cambr.) and *Tiso æstivus* (C. L. Koch) (Å. Holm, 1937, Arkiv för Zoologi, Stockholm, 29 B, 12, 1). These species and all other micryphantids in the collection are mainly Palæarctic. *Dictyna borealis* Cambr. and *Hahnia glacialis* Sör. are endemic to Greenland, and the only Lycosid, *Lycosa groenlandica* Thor., exclusively Nearctic.

List of the Species.

1. *Dictyna borealis* Cambr.

1 ♂, 1 ♀ ad., 1 juv. Under stone at 300 ft., east of base, 12. v. 36.

1 ♂, 3 ♀♀ ad., 2 juv. Under vegetation at 300 ft., east of base, 15. v. 36.

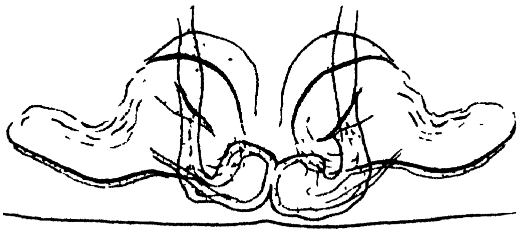
1 ♀ ad., 1. vii. 36.

1 ♀ ad., 1 juv. Under vegetation 60 m. from coast. 30. vii. 36.

1. juv. Under rocks and vegetation, 31. vii. 36.

An exclusively Greenland species. The male palpus is figured by Emerton (1919, p. 144, figs. 3–6: *D. hamifera* Thor.) and the female epigyne recently by Jackson (1934 *a*, pl. xviii. fig. 2). I give a figure of the internal (and external) shape of the epigyne, which will characterize this species (fig. 1). The receptacula seminis are lying close together in the posterior part of the epigyne,

Fig. 1.



Epigyne of *Dictyna borealis* Cambr.

and each receptaculum emits on its outer side a short duct, which runs forwards and opens into the middle of the broader, inner part of the oblong depression on each half of the epigyne. The posterior and antero-internal margins of these depressions are chitinized and sharp-edged.

This species is recorded from Greenland by Cambridge, 1877 (*D. b.*), Lenz, 1897 (*D. groenlandica*), Sörensen, 1898 (*D. hamifera* Thor.; ad. part), Emerton, 1919 (*D. hamifera* Thor.), Jackson, 1934 and 1938 (*D. b.*), and Braendegaard, 1935 and 1937 (*D. b.*).

Distribution.—West and East Greenland.

2. *Hahnia glacialis* Sör.

1 ♀ ad. Under stones, 200 ft., east of base, 28. v. 36.

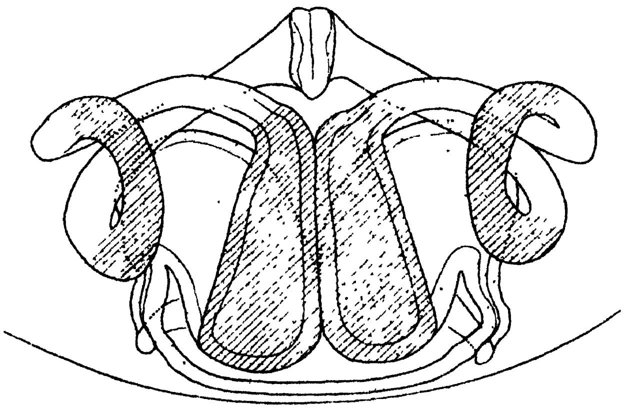
1 ♂ ad. Kraemer's Bay. On stones at 1000 ft., 17. vi. 36.

1 ♀ ad. Under stones, 300 ft., north-east of base.

Sörensen's description of *Hahnia glacialis* does not agree with the specimens in the present collection. In his description (Sörensen, 1898, p. 219) Sörensen states that the posterior row of eyes is strongly procurved, the interval between the posterior central eyes as long as the double eye diameter, and the area of the central eyes much longer than broad behind.

Dr. Kai Henriksen, Zoological Museum in Copenhagen, has kindly sent me a female specimen of Sörensen's types, and I am therefore able to state the complete identity of the specimens in the present collection and this species.

Fig. 2.



Epigyne of *Hahnia glacialis* Sor.

The posterior row of eyes is slightly procurved (the anterior tangent of the central eyes goes through the centre of the lateral eyes), the posterior central eyes are separated from each other by an interval only somewhat larger than their diameter, and the area of the central eyes is a little shorter than broad behind. The height of the clypeus is twice as great as the diameter of the anterior lateral eyes. The epigyne is of a very characteristic shape when cleared and examined transparently. The two long, winding ducts from the receptacula seminis have a common opening at the front of the epigyne: in all other species of *Hahnia* which I know this opening is at the hind part of the epigyne. The form of the

receptacula and the convolution of the ducts is illustrated in fig. 2; the hatched parts are to be seen on the intact epigyne when immersed in alcohol.

Also Braendegaard, 1937, and Jackson, 1938, have recorded this species from Greenland.

Distribution.—West and East Greenland.

3. *Meioneta nigripes* (Sim.).

2 ♂♂ ad. Under stones at 300 ft., north-east of base, 29. v. 36.

2 ♀♀ ad. Under vegetation at 6500 ft., 2. vii. 36.

1 juv. Under vegetation, 13. vii. 36.

2 ♂♂ ad., 1 juv. Under vegetation on sedimentary ridge at 4500 ft., 25 miles from coast, north-east of base. 25. vii. 36.

1 juv. Under vegetation, 30. vii. 36.

3 juv. Under rocks and vegetation, 31. vii. 36.

1 ♂ ad. Coal corner. Under vegetation, 4. viii. 36.

3 ♂♂, 1 ♀ ad., 4 juv. Under vegetation, 5. viii. 36.

The specimens in the present collection resemble those which I have seen from the Swedish mountains. Even the young are easy to determine by means of the great posterior central eyes.

This species has previously been recorded from Greenland by Sörensen, 1898 (*Tmeticus levinsenii*), Jackson, 1934 (*M. n.*), and Braendegaard, 1937.

Distribution.—N. America, E. and W. Greenland, Jan Mayen, Spitsbergen, Iceland, Faroes, Scotland, Scandinavian mountains, French and Swiss Alps, Tyrol.

4. *Hilaira frigida* (Thor.).

1 ♀ ad. Under stones at sea-level, south of base, 17. v. 36.

1 ♂, 1 ♀ ad., 3 juv. Under stones at 400 ft., east of base, 2. vi. 36.

1 ♀ ad., 1 juv. Under rocks at 200 ft., east of base, 10. vi. 36.

1 juv. Kraemer's Bay. On stones at 3000 ft., 17. vi. 36.

1 juv. Under vegetation at 300 ft., east of base.

This species has been recorded from Greenland by Thorell, 1872 (*Erigone f.*), Sörensen, 1898 (*Tmeticus f.*), Jackson, 1930, 1934, and 1938 (*H. f.*), and Braendegaard,

1935 and 1937 (*H. f.*). The "*Erigone frigida* Thor." of Lenz, 1897, is *Hilaira vexatrix* (Cambr.).

Distribution.—West and East Greenland, Jan Mayen, Iceland, Faroes, Britain, and Scandinavia.

5. *Caledonia evansii* (Cambr.)

1 ♀ ad. Under stones at sea-level, south of base, 17. v. 36.

This species has newly been recorded from Greenland by Braendegaard, 1937. The only specimen corresponds very well with those from Swedish mountains.

Distribution.—East Greenland, Iceland, Britain, Sweden.

6. *Coryphæolana holmgreni* (Thor.).

1 ♀ ad., 2 juv. Under stones at 400 ft., east of base, 2. vi. 36.

1 juv. Under rocks at 200 ft., east of base, 10. vi. 36.

This species has been recorded from Greenland by Lenz, 1897 (*Erigone groenlandica*), Sörensen, 1898 (*Walckenaera similis*), Jackson, 1934 and 1938 (*Coryphæolanus h.*), and Braendegaard, 1937 (*C. h.*).

Distribution.—West and East Greenland, Jan Mayen, Spitsbergen, Bear Island, Iceland, Faroes, Scotland, Scandinavia, Novaya Semlya, Siberia.

7. *Erigone tirolensis* L. Koch.

1 ♀ ad. Under stones at 300 ft., north-east of base, 29. v. 36.

1 ♀ ad. 5½ miles inland, west side of Calving glacier, at 3000 ft., 16. vii. 36.

This species is recorded from Greenland by Braendegaard, 1935 and 1937 (*E. t.*), and Jackson, 1938 (*E. t.*).

Distribution.—North America, East Greenland, Jan. Mayen, Spitsbergen, Iceland, Britain, Tyrol, Swiss Alps, Scandinavian Mountains, Novaya Semlya, and Siberia.

8. *Microerigone spetsbergensis* (Thor.).

1 ♀ ad. Under vegetation on sedimentary ridge at 4500 ft., 25 miles from coast, north-east of base, 25. vii. 36.

This species is recorded from Greenland by Thorell, 1872 (*Erigone s.*), Braendegaard, 1937, and Jackson, 1938.

are of great value and often provide the only available evidence. There are, however, instances in which abundant data for statistical investigation are furnished by the wild animals themselves. Thus the long-eared bat has the convenient habit of eating moths—its regular food—while it hangs suspended from a surface to which it returns after each capture ; and as the wings are rejected, these may be collected in large numbers, yielding valuable information on the significance of concealing and warning patterns.

In the attempt to determine the motive causes of organic evolution, the work of the naturalist, the student of living nature, is essential. His task is to do what Lyell did for geology by directing attention to the forces now in operation and seeking with their help to interpret the past, and in this work it is especially valuable to study adaptations which have been developed in recent times and can, in certain instances, be proved to undergo changes even now. Thus the interesting observations of H. Lyster Jameson showed that a pale local race of the common mouse had been formed, although incompletely, in from 100 to 125 years, by the selective attacks of owls and hawks on sandhills near Dublin.[20] I therefore believe that the colours of animals provide one of the most fruitful fields in which to pursue these investigations, and I regret that this work has been recently attacked by an American zoologist who, referring to the recent revival of natural selection, continues—'if the doctrine can emerge minus its sexual selection, its warning colors, its mimicry and its signal colors, the reaction over the end of the century will have been a distinct advantage.'[21] It is of course impossible to discuss, on the present occasion, this confident attempt to depreciate the value of work associated with the names of Bates, Wallace, Trimen and Fritz Müller. I will only point out that their conclusions on warning colours and mimicry have been immensely strengthened and confirmed by the later observations of Guy Marshall, W. A. Lamborn, St. Aubyn Rogers, Hale Carpenter, V. G. L. van Someren and others in Africa ; by the experiments conducted by some of these naturalists, and also by H. B. Cott and R. Carrick, and in the United States by Morton Jones.

It is interesting to remember that a paper by two American entomologists[22] was among the first to accept and support by fresh observations the conclusions brought forward by H. W. Bates in his great memoir on the mimetic butterflies of the Amazon Valley,[23]

[20] *Journ. Linn. Soc.* (Zool.), vol. 26, 1898, p. 465, pl. 30.
[21] *Evolution.* A. Franklin Shull. (New York, 1936.)
[22] Walsh and Riley : *The American Entomologist*, St. Louis, Mo., 1869, vol. i, p. 189.
[23] *Trans. Linn. Soc. Lond.*, vol. xxiii, 1862, p. 495.

Distribution.—Arctic America, West and East Greenland, Spitsbergen, Novaya Semlya, Siberia.

9. *Tiso æstivus* (L. Koch).

1 ♀ ad. Under stones at 200 ft., east of base, 28. v. 36.

1 ♀ ad. North bank, Miki Fjord. Under stones and vegetation, 10. vi. 36.

Recorded from Greenland by Braendegaard, 1937.

Distribution.—East Greenland, Iceland, Britain, Scandinavia, Tyrol, Tatra, Kamchatka.

10. *Lycosa groenlandica* Thor.

1 ♀ juv. Under rock at 300 ft., south of base, 12. v. 36.

1 ♂ juv. Under stone at sea-level, south of base, 17. v. 36.

1 juv. Under stone at 300 ft., east of base, 24. v. 36.

3 juv. Under stones at 300 ft., east of base, 24. v. 36.

1 ♂ juv. Under stone at 200 ft., east of base, 28. v. 36.

1 juv. Under stone at 200 ft., east of base, 28. v. 36.

1 juv. Under stone at 300 ft., north-east of base, 29. v. 36.

1 juv. Under stone at sea-level, south of base, 31. v. 36.

1 ♀ ad. with egg cocoon. Horseshoe Mts., at 3500 ft., 4. vi. 36.

1 juv. Under stone at sea-level, south of base, 8. vi. 36.

1 ♀ ad., 2 juv. North Bank, Miki Fjord. Under stones and vegetation, 10. vi. 36.

2 juv. Under stones at 50 ft., east of base, 12. vi. 36.

3 juv. Kraemer's Island. 60–300 ft., north of base, 13. vi. 36.

1 ♂ ad., 3 juv. On stones at 1000 ft., Kraemer's Bay, 17. vi. 36.

1 juv. Kraemer's Island, 19. vi. 36.

1 ♀ ad., 4 juv. On stones at 300 ft., Kraemer's Bay, 17. vi. 36.

1 ♀ ad. Ravens rock, 40 ft. up, 21. vi. 36.

1 ♂ ad., 3 juv. On rocks at 2000 ft., South Syenite glacier, 27. vi. 36.

1 ♂, 1 ♀ ad. 1 juv. 1. vii. 36.

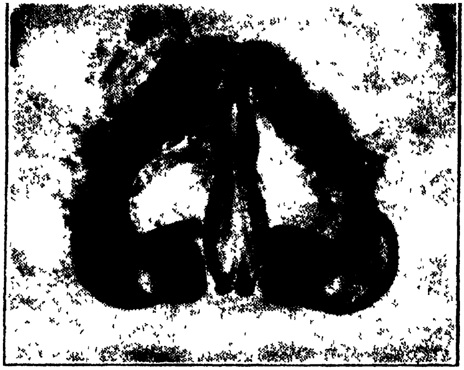
3 juv. On rocks at 1500 ft., 2. vii. 36.

1 juv. 3. vii. 36.

1 ♂ ad. On rock, 2000 ft., at Citadel, 13. vii. 36.

1 ♀ ad., 1 juv. 5½ miles inland, west side of Calving glacier, at 3000 ft., 16, vii. 36.

Fig. 3.



Epigyne of *Lycosa groenlandica* Thor.

Fig. 4.

a. Male palpus of *Lycosa groenlandica* Thor., external view.
b. Do., middle part of bulbus, ventral view.

4 juv. On stones (common), 30. vii. 36.

1 ♂, 2 ♀♀ juv. On stones, 30. vii. 36.

1 ♂ juv., 2 juv. 65 miles from coast, 5000–5500 ft., 31. vii. 36.

This species belongs to the same *Lycosa*-group as the European species *Lycosa atrata* Thor., *Lycosa lapponica* Thor., *Lycosa ferruginea* L. Koch, and *Lycosa septentrionalis* Westr. The epigyne of the female in this group has a deep heart- or bottle-shaped fovea, surrounded by a thick chitinized margin and divided by a longitudinal septum. Fig. 3 shows the epigyne of *Lycosa groenlandica*. I give also figures of the male palpus; in fig. 4 *a* the palpus is seen from the external side, and in fig. 4 *b* the middle part of the bulbus is shown from the ventral side. The bulbus has a long transverse embolus (fig. 4, *emb*) and two short apophyses, the one in the middle of the external side and the other in a little fovea of the basal part. In the males of the present collection the embolus is somewhat broader than in the figured specimen, which belongs to Thorell's collection.

Distribution. Arctic America, West and East Greenland.

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On some Collembola from Iceland and Greenland.

By JAMES MEIKLE BROWN, B.Sc., F.L.S., F.R.E.S.

THROUGH the kindness of Professor G. D. Hale Carpenter of Oxford, to whom I am deeply indebted, I have had the opportunity of examining four small collections of Collembola recently brought back from the Arctic Regions. Though most of the species are common ones, such as would be most obvious to collectors, they are of interest in adding to our knowledge of the distribution of these insects. Collembola are of particular interest in dealing with questions of geographical distribution, as, being entirely wingless, they have little means of dispersing themselves over great distances,and in the Arctic Regions at any rate, are little likely to be transported frequently

by human agency. Any additional information, therefore, regarding their distribution is of value.

The material dealt with in the present communication, now in the Hope Department of Entomology, Oxford University Museum, is as follows :—

a. From West Iceland : Snaefells Peninsula, c. 4 miles east of Budir. Three tubes containing three species, collected by Misses P. M. Lupton and U. M. Wykes, June 1935.

b. From East Greenland : Miki Fjord and Kraemers Bay. Three tubes containing three species, collected by the members of the British Expedition to East Greenland, 1935–36, led by L. E. Wager.

c. From West Greenland : Lat. 67°. Three tubes also containing three species, collected by H. G. Vevers on the Oxford University Greenland Expedition, June–July 1936.

d. From West Greenland : Lat. 67°. Two tubes of material, containing two species, collected from the seashore by D. M. Steven on the Oxford University Greenland Expedition, June–July 1936.

Species and Localities.

Order COLLEMBOLA Lubb.

Suborder Arthropleona Börn.

Family **Hypogastruridæ** Börn.

1. *Hypogastrura armata* (Nic.).

1841. *Podura armata* Nicolet, Nouv. Mém. Soc. Helv. Nat. p. 57.
1871. *Achorutes armatus* Tullberg, Öfv. Kongl. Vet.-Akad. Förhandl. p. 153.
1912. *Hypogastrura armata* Linnaniemi, Acta Soc. Sc. Fenn. p. 13.

Locality.—East Greenland: Miki Fjord. Numerous specimens in a fungus, at 100 feet, 6.v.36.

This species is almost world-wide in its distribution, extending from the Arctic in the north, as far south as New Zealand.

Previous recent records include :—

Lapland (Ågren, 1904 ; Brown, 1931 ; Brown, 1936). Greenland (Folsom, 1919 *a*). North-West Territories (Folsom, 1919 *b*). Iceland (Davies, 1936).

2. *Xenylla humicola* (O. Fabr.) Tullb.

1780. *Podura humicola* O. Fabricius, Fauna Groenlandica, p. 213.
1876. *Xenylla humicola* Tullberg, Öfv. K. Sv. Vet.-Akad. Förhandl. p. 39.
1912. *Xenylla humicola* Linnaniemi, Acta. Soc. Sc. Fenn. p. 42.

Locality.—West Greenland : Amerdloq Fjord, lat. 67° ; Utorkait.

Numerous specimens, June–July 1936.

This is a common species in Northern and Middle Europe and in North America. It was originally described from specimens taken in Greenland. It frequently occurs on the coast as well as inland, and has been taken in Britain and in the Azores.

Previous recent records include :—

Lapland (Brown, 1936). Spitsbergen (Carpenter and Phillips, 1922 ; Carpenter, 1927).

Family **Onychiuridæ** Börn.

3. *Onychiurus armatus* (Tullb.).

1869. *Lipura armata* Tullberg. Akad. Afhandl. Upsala, p. 18.
1872. *Lipura armata* Tullberg, Kongl. Sv. Vet.-Akad. Handl. p. 56.
1901. *Onychiurus armatus* Börner, Zool. Anz. p. 698.
1912. *Onychiurus armatus* Linnaniemi, Acta Soc. Sc. Fenn. p. 86.

Locality.—West Iceland : Snaefells Peninsula. A single very small specimen on roots of grass in a bog, 23. vii. 35.

The single specimen taken seems to belong to the type and not to the arctic variety. It has previously been recorded from Bear Island.

2 *a*. *Onychiurus armatus* var. *arcticus* (Tullb.).

1876. *Lipura arctica* Tullberg, Öfv. K. Sv. Vet.-Akad. Forhandl. p. 39.
1904. *Onychiurus armatus* var. *arcticus* Ågren, Arkiv. f. Zool. p. 12.

Locality.—West Greenland : Camp Lloyd, Søndre Strømfjord, lat. 67°.

Three specimens. June–July 1936.

This is a widely distributed arctic form and has been taken more frequently at higher latitudes than the type form.

Previous recent records include :—

Lapland (Ågren, 1904; Brown, 1936). Spitsbergen (Carpenter and Phillips, 1922; Carpenter, 1927). West Spitsbergen (Brown, 1936). Iceland (Davies, 1936).

Family **Isotomidæ** Börn.

4. *Folsomia quadrioculata* (Tullb.).

1871. *Isotoma quadrioculata* Tullberg, Öfv. K. Vet.-Akad. Förhandl. p. 152.
1912. *Folsomia quadrioculata* Linnaniemi, Acta Soc. Sc. Fenn. p. 111.

Locality.—West Greenland: Camp Lloyd, Søndre Strømfjord, lat. 67°.

Two specimens, June–July 1936.

A small species commonly found in moss, under bark and in similar situations, and widely distributed in the Northern Hemisphere.

Previous recent records include :—

Lapland (Ågren, 1904; Brown, 1931; Brown, 1936). Spitsbergen (Carpenter and Phillips, 1922; Carpenter, 1927). West Spitsbergen (Brown, 1936). North-West Territories (Folsom, 1919 *b*). Hudson Strait (Brown, 1932).

5. *Archisotoma besselsi* (Pack.).

1877. *Isotoma besselsi* Packard, Amer. Nat. p. 52.
1899. *Isotoma spitzbergensis* Lubbock, Journ. Linn. Soc. Lond. p. 616.
1912. *Archisotoma besselsi* Linnaniemi, Acta Soc. Sc. Fenn. p. 119.

Locality.—West Greenland: Søndre Strømfjord, lat. 67°.

Numerous specimens taken at the head of the fjord from silt along the shore.

This is a characteristic coastal species, occurring in Greenland, Spitsbergen, North America, and other Arctic lands, and frequently also on the coasts of Britain, reaching even the south coast (Brown, Ent. Mon. Mag. 1921, p. 19) It extends as far south as Tierra del Fuego. Folsom states (1919*a*, p. 278) that the species is known to range from northern Greenland almost to the Antarctic Circle, and in his opinion, owes its exceptional distribution to marine currents.

Previous recent records include :—

Spitsbergen (Carpenter and Phillips, 1922; Carpenter, 1927). Greenland (Folsom, 1919 *a*). Hudson Strait (Brown, 1932).

6. *Isotoma* (*Pseudisotoma*) *sensibilis* Tullb.

1876. ***Isotoma sensibilis*** **Tullberg, Öfv. K. Sv. Vet.-Akad. Förhandl. p. 36.**
1912. ***Isotoma*** **(*Vertagopus*)** ***sensibilis*** **Linnaniemi, Acta. Soc. Sc. Fenn. p. 143.**
1924. ***Pseudisotoma sensibilis*** **Handschin, Mem. Soc. helv. Sci. nat. p. 111.**
1929. ***Isotoma*** **(*Pseudisotoma*)** ***sensibilis*** **Handschin, Die Tierwelt Deutsch. xvi. p. 64.**

Locality.—East Greenland: Kangerdlugsuak, Kraemers Bay, 100 feet. One specimen, 17. vi. 36.

This species occurs throughout Northern Europe and Northern America. It is found frequenlty in moss and under bark in Britain.

Previous recent records include :—

Lapland (Ågren, 1904; Brown, 1936). Hudson Strait (Brown, 1932).

7. *Isotoma* (*Vertagopus*) *arborea* (L.) Ågren.

1903. ***Isotoma arborea*** **Ågren, Stettin. Entom. Zeitung. p. 140.**

Locality.—East Greenland: Kangerdlugsuak, Kraemers Bay. Numerous specimens, 6. viii. 35.

This species described by Ågren from Swedish specimens, occurs commonly as a winter species. It is widely distributed and occurs also, mainly as a winter form, in Britain. It resembles *Isotoma* (*Vertagopus*) *cinerea* (Nic.) very closely in many respects, but can be distinguished from that species by the two small inner posterior ommatidia, the number of tenent haris on the legs, viz., two on leg i., and three on each of legs ii. and iii., the curved lower edge of the mucro, and the very dark violet-purple colour.

It does not seem to have been recorded from so far north previously, and not, I believe, from Greenland.

8. *Isotoma viridis* (Bourl.).

1839. ***Isotoma viridis*** **Bourlet, Mem. Soc. des Sc. de l'Agricult. de Lille, p. 401.**

Locality.—West Iceland: Snaefells Peninsula. Two specimens, on the surface of a stream from a bog, 23. vii. 35.

This is one of the commonest and most widely distributed species of Collembola. It occurs in a variety of

situations, but is not normally found on the surface of water.

Previous recent records include :—

Lapland (Ågren, 1904; Brown, 1931; Brown, 1936). Iceland (Davies, 1936). Spitsbergen (Carpenter and Phillips, 1922; Carpenter, 1927). West Spitsbergen (Brown, 1936). Alaska (Folsom, 1902; Folsom, 1919 *b*). Hudson Strait (Brown, 1932). North-West Territories (Folsom, 1919 *b*).

Family **Entomobryidæ** Börn.

9. *Lepidocyrtus lanuginosus* (Gmel.).

1872. *Lepidocyrtus lanuginosus* Tullberg, K. Vet.-Akad. Handl. p. 38.
1904. *Lepidocyrtus lanuginosus* f. *typica* Ågren, Arkiv. f. Zool. p. 24.

Locality.—West Iceland: Snaefells Peninsula. Four specimens, at grass roots and moss in a wet bog, 23. vii. 35.

This is another species which is quite plentiful throughout the Northern Hemisphere. In the higher latitudes, perhaps the variety *fucata* (Uzel) is more frequently met with.

Recent records for the type-form include :—

Lapland (Ågren, 1904; Brown, 1931; Brown, 1936). Spitsbergen (Carpenter, 1927). Iceland (Davies, 1936).

10. *Lepidocyrtus cyaneus* Tullb.

1871. *Lepidocyrtus cyaneus* Tullberg, Öfv. K. Vet.-Akad. Förhandl. p. 150.
1912. *Lepidocyrtus cyaneus* Linnaniemi, Acta Soc. Sc. Fenn. p. 225.

Locality.—West Greenland: Amerdloq Fjord, lat. 67°. One specimen, June-July 1936.

This is a common species in the Northern Hemisphere, and extends southward into Africa. It has not been taken in the Arctic Regions very frequently.

Recent records include :—

Lapland (Ågren, 1904). Alsaka (Folsom, 1919 *b*).

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and that one of the authors treated the same subject more completely in a later paper [24] much appreciated by Darwin.[25]

It is also important to remember that the above-mentioned conclusions have been reached by the study of marine animals no less than terrestrial, as was shown by Herdman in his address to Section D at Glasgow in 1901, and by his experiments communicated to the same Section at Ipswich in 1895; also that Garstang, with his very long and intimate experience of marine life, adopts the same interpretation of colour and form with the associated attitudes and movements.

If time permitted it would be possible to speak of numerous papers on mimicry and the related subjects which have been brought before our meetings. It is impossible to attempt this now, but many will feel with me that the name of the late Dr. F. A. Dixey should not be forgotten—one who attended so regularly, so often read papers at our meetings, presided over Section D at Bournemouth in 1919, lectured at Leicester in 1907, always giving the results yielded by the study of his favourite insects, and their interpretation by the theory of natural selection; also one who delighted in the social gatherings of his Section, where his rendering of *Widdicombe Fair* will be long remembered.

In my concluding remarks I am anxious to refer to a very interesting and encouraging subject—the feeling for animals and the care for their welfare to-day, as contrasted with the treatment they received a hundred years ago and even in the youth of many among us. Only last autumn *The Times* of October 12, reported that 1,000 swallows had arrived at Venice 'sent there by bird-lovers from Vienna and Munich in order to save them from the effects of the cold weather. Soon after their arrival they were set free and flew south along the Adriatic coast.' And a little earlier the writer of the amusing 'Fourth Leader' referred to a meeting of the Society for the Preservation of the Fauna of the Empire at which the care of the opossum was discussed, comparing this with the report of happenings a hundred years earlier when there was a 'humorous debate' at the Zoological Society 'about puffing cigar-smoke into the cages of the monkeys,' to their evident discomfort. The writer, yielding too far, we hope, to the depression of the present day, concludes: 'The world, it may be, is "man-sick" and yearning to be rid of a bad mistake. But the creature cannot be wholly vile when instead of torturing monkeys it takes thought for the opossum.' It would not be right to quote from a century-old report without

[24] Riley: *Third Annual Report on the Noxious . . . Insects of . . . Missouri*, 1871, p. 142.

[25] *Charles Darwin and the Theory of Natural Selection* (Poulton, 1896), p. 202.

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Carpenter, G. H., & Phillips, K. C. J. 1922. "The Collembola of Spitsbergen and Bear Island." Proc. Roy. Irish Acad. xxxvi. B, p. 11.

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——. 1919 *b*. 'Report of the Canadian Arctic Expedition, 1913–18.—III A.' Ottawa.

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Linnaniemi, W. M. 1912. "Die Apterygoten-fauna Finlands." Acta Soc. Sc. Fenn. xl.

Tullberg, T. 1871. "Förteckning öfver Svenska Podurider." Öfv. Kongl. Vet.-Akad. Forhandl. xxviii.

——. 1872 "Sveriges Podurider." K. Sv. Vet.-Akad. Forhandl. x.

——. 1876. "Collembola Borealia." Öfv. K. Sv. Vet.-Akad. Forhandl. xxxiii.

Wahlgren, E. 1900. "Collembola wahrend der Schwedischen Grönlands Expedition 1899, aus Jan Mayen und Ost-Gronland eingesammelt." Öfv. K. Sv. Vet.-Akad. Forhandl. lvii.

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Results of the Oxford University Expedition to Sarawak (*Borneo*), 1932. Acridiidæ (*Orthoptera*). By C. WILLEMSE, Eygelshoven, Holland.

WITH but three exceptions (indicated by the use of square brackets) all the Acridiidae recorded in this paper were collected by the Oxford University Expedition in which Dr. B. M. Hobby and Mr. A. W. Moore participated as entomologists. A general account of the expedition with a map of the area visited was published by T. H. Harrison, 1933, Geogr. J. vol. lxxxii. pp. 385–410; some of the ecological and botanical results are described by P. W. Richards, 1936, J. Ecol. xxiv. pp. 1–37, 340–360. The chief collecting stations were as follows :—

Mt. Dulit.—(*a*) Secondary forest in the vicinity of the base camp at the foot of the range, *i. e.*, on its north-eastern side where the River Tinjar receives the R. Lejok on its left bank (altitude less than 325 feet).

(*b*) Primary "Mixed forest" along the trail leading from the base camp to the high camp.

(*c*) Primary "Moss forest" around the high camp at 4000 feet.

(*d*) Primary "Heath forest" around the Koyan camp at 2500 feet on the south-western side of the range.

R. Kapah.—Primary "Mixed forest" near the R. Kapah, a right-bank tributary of the Tinjar about half a mile below the Lejok (altitude little more than that of base camp).

A few specimens were also taken in the "Heath forest" (white sand forest) at Claudetown (also known as Marudi or Baram) at an altitude of less than 160 ft. and on Mt. Kalulong, respectively about 60 miles to the north and 30 miles to the west of the base camp.

Most of the collection is preserved in the British Museum (Nat. Hist.); selected specimens are in the Oxford University Museum, Sarawak Museum, and my own collection; a single *Coloracris cærulescens*, sp. n., is in the Stockholm Museum.

In the following lists reference to the year of capture is omitted, as all the specimens, except the three mentioned above, were taken in 1932.

Subfamily *Eumastacinæ*.

Chorotypus gallinaceus Fabr.

Mt. Kalulong, primary forest, 1800 ft., 2. xi., 1 ♀ (defective).

Erucius vitreus West.

This species was unknown from Borneo A careful comparison with the description and the related species *apicalis* West. makes the identification certain.

Foot of Mt. Dulit, trap baited with fish, flood refuse of cut reeds, on leaves in undergrowth, 28. viii.–10. ix., 5 ♂♂. R. Kapah, primary forest, from fungus, 24. ix.–7. x., 2 ♂♂.

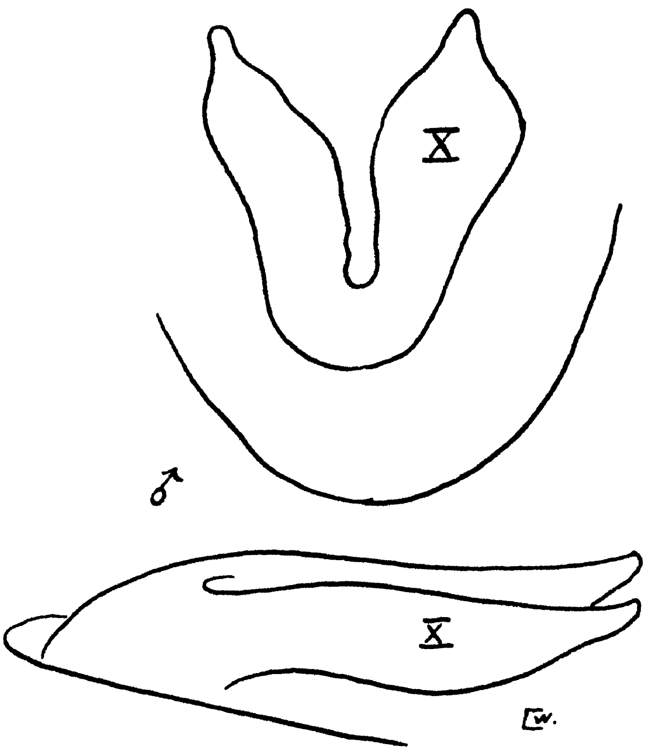
Erucius dusmeti Bol. C.

Mt. Dulit, moss forest, 4000–4500 ft., 14–29. x., 6 ♂♂ (one at light). Mt. Dulit, R. Koyan, primary forest, 2500 ft., 17. xi., 4 ♂♂.

Erucius moultoni Bol. C.

I am not sure of the determination, as I have no material for comparison. The elytra bears two dark transverse bands instead of one. The subgenital plate is not always of the same shape, sometimes being distorted by too rapid preservation. (Figs. 1–3.)

Fig. 1.



Erucius moultoni Bol. C., ♂.
Tergite X., seen from above and from aside.

Foot of Mt. Dulit, on shingle of river bed, 22. viii., 1 ♂. Dulit trail, primary forest, 16. viii., 1 ♂. R. Kapah, primary forest, from fungus, 24. ix., 4 ♂♂.

Fig. 2.

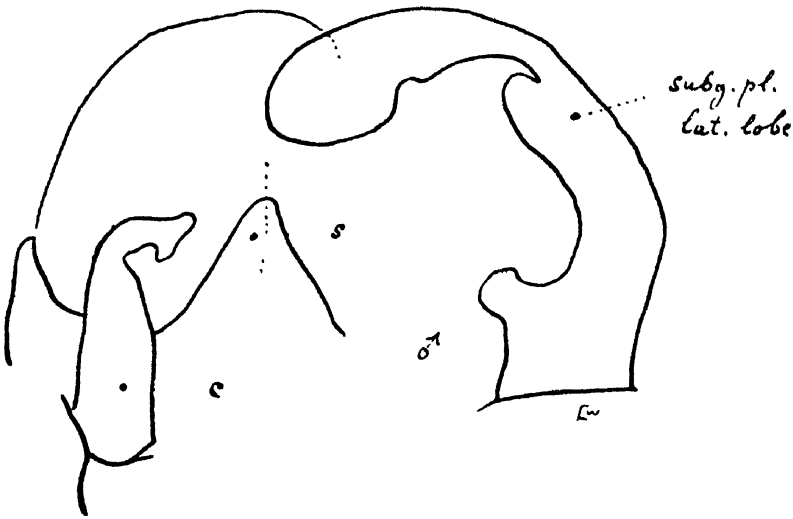
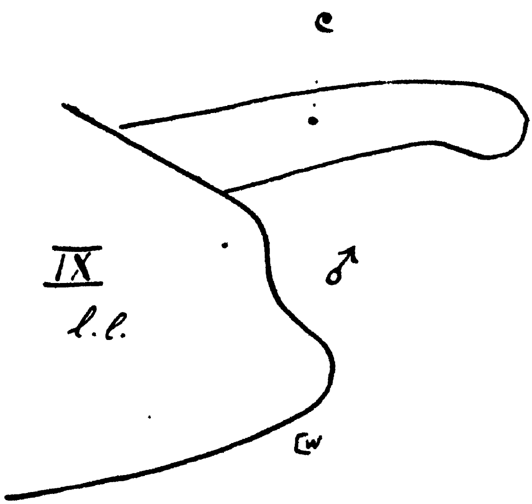


Fig. 3.



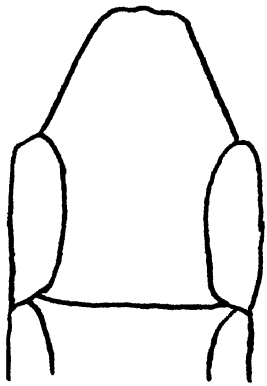
Erucius moultoni Bol. C., ? ♂.

Fig. 2.—Supra-anal plate and cercus, from above.
Fig. 3.—Lateral lobe of tergite IX. and cercus, seen from aside.

Eupatrides excelsus Brunn. v. Wattenw.

Foot of Mt. Dulit, near base camp, viii., 1 ♀. Fig. 4 illustrates the previously unfigured subgenital plate of the female.

Fig. 4.



Eupatrides excelsus Br. v. W.
♀ subgenital plate.

Mnesicles poultoni Bol. C.

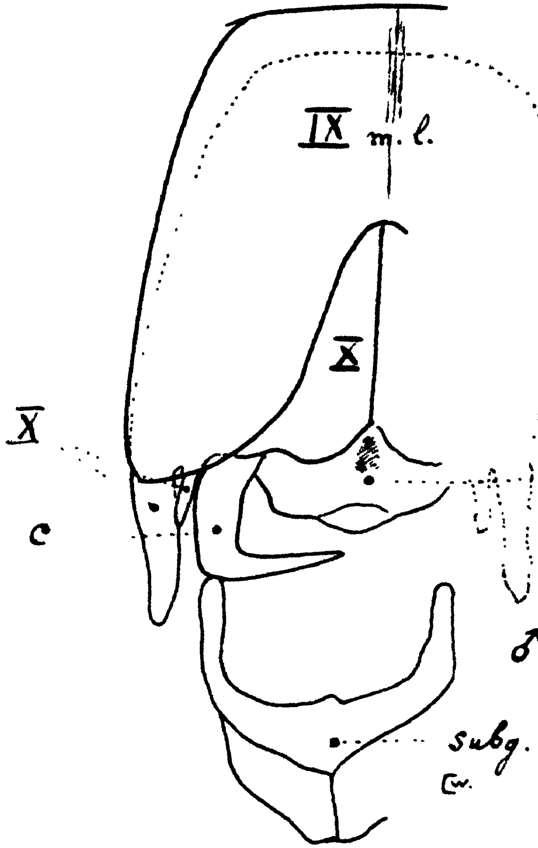
♂. Vertex with a faintly indicated median keel, rugosely sculptured on each side and on the cheeks. Fastigium of vertex horizontally produced in front of the eyes, about twice as long as broad, margins distinct and parallel, apex rounded. Frontal ridge with the margins distinct and thickened, distinctly widened above the median ocellus, below the median ocellus X-shaped, reaching the clypeal margin. Lateral facial keels distinct and thickened, slightly narrowed in the upper part, lower part straight and parallel. First antennal joint normal. Pronotum cylindrical, with the anterior margin truncate, posterior margin slightly rounded; median keel distinct near the anterior margin and in the metazona. Elytra reaching the apical fourth of hind femora, with fairly dense reticulation, anterior area slightly dilated near the base, anterior and posterior margin nearly parallel, apex rounded. Wings subcycloid. Anterior and median femora somewhat thickened, anterior femora with the lower outer margin smooth. Hind femora with the upper keel and upper outer keel distinctly

dentate, with regular sharp teeth ; the other keels and lower keels indistinctly dentate, only with some small sparse and blunt teeth. Hind tibiæ with 23 outer and 15 inner spines. Outer apical spines small, equal in length. Posterior metatarsus with a longitudinal sulcus from above, inner margin finely serrate, outer margin nearly smooth with a row of 3 small teeth at the apex, continuing towards the pulvillus. Abdomen with the penultimate segments expanded, tergites with a fine longitudinal median keel ; 8th tergite normal, posterior margin truncate ; 9th tergite with a very large median lobe and a free smaller lateral lobe. The median lobe is somewhat tectiform in shape, covering a great part of the tenth tergite, its posterior margin deeply and roundly excised ; forming a rounded lobe on each side, lower margin straight. Lateral lobe smaller, somewhat longer than broad, its apex rounded triangular. The tenth tergite for the most part covered by the ninth tergite, its posterior margin slightly excised in the middle ; the tergite is on each side continued into two processes, the upper one being very small and closed round the insertion of the cercus, the lower one larger. both partly concealed by the median lobe of the ninth tergite and only visible at the posterior margin of the ninth tergite. Supra-anal plate triangular, apex rounded, in the specimen examined it is turned upwards. Cercus cylindrical in its basal half, slightly curved, near the middle sharply bent inwards at an angle of about 90°, apical half strongly attenuated, apex more or less sharply pointed. Sub-genital plate curved upwards, apex triangularly excised on both sides, near the apex with a small median keel on its lower surface, the very apex rounded with a very small excision in the middle.

General coloration yellowish brown. Head brown with a pattern of small symmetrical reddish-brown spots along the frontal ridge, lateral keels, and on the cheeks. Eyes brown. Antennæ black with the basal joïnt reddish brown. Pronotum reddish brown, with irregular brown spots, especially on the lateral lobes, median keel in the metazona black, near the middle of anterior margin with a black spot. Epimerum of meso- and metathorax reddish brown, with blackish-brown spots. Elytra brown, with a hyaline spot near the apex and hyaline along the anterior margin. Wings hyaline.

Anterior and median legs yellowish brown, tibiæ near the apex and tarsi darker-coloured. Hind femora yellowish brown, with a regular row of black stripes or spots along the outer and inner keels; knee brown. Hind tibiæ yellowish brown, darker apically, spines black. Hind

Fig. 5.



Mnesicles poultoni Bol. C., ♂.

Apex of abdomen seen from above. IX *m.l.*, median lobe of tergite 9; X, tergite 10; *c*, cercus; *s*, supra-anal plate; *subg.*, subgenital plate.

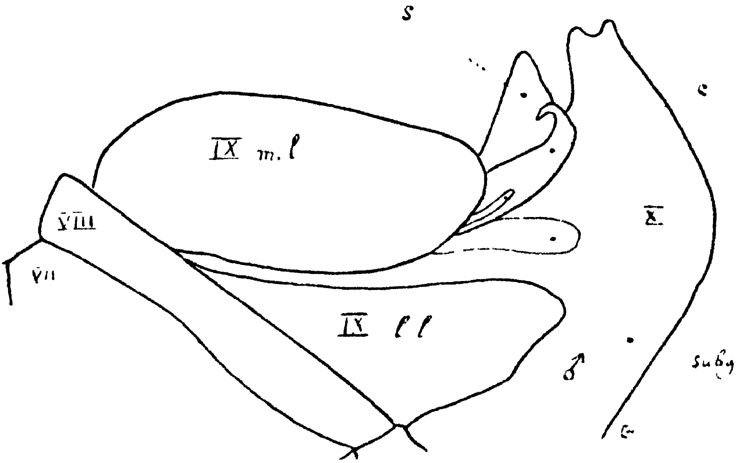
tarsi yellowish brown. Abdomen yellowish brown, with a row of black spots from above and a row of small black stripes on each side. Median lobe of the ninth tergite in the male yellow. (Figs. 5, 6.)

♂. Length of body 19 mm., of pronotum 2·5 mm., of elytra 13 mm., of hind femora 13 mm.

Foot of Mt. Dulit, in house, 5. x., 1 ♀. Mt. Dulit, moss forest (in high camp house), 4000 ft., 15. x., 1 ♂.

This species was described by Bolivar (1931, Bol. Soc. Esp. Hist. nat. xxxi. pp. 292, 299, fig. 10) after a female. The male was unknown and Bolivar supposed he had an aberrant species before him. The discovery of the male makes it clear that it is really an aberrant form, probably a new genus. The large development of the median lobe

Fig. 6.



Mnesicles poultoni Bol. ♂.

IX *m.l.*, median lobe of ninth tergite; IX l.l., lateral lobe of ninth tergite; X, processus of hind margin of tenth tergite; *c*, cercus; *s*, supra-anal plate.

of the ninth tergite, covering the largest part of the tenth tergite, makes it very different from all other known species. It is best not to establish a new genus until more material is available for comparison with other species of the genus.

Subfamily Acridinæ.

Aiolopus tamulus Fabr.

Claudetown, primary white sand forest, wide sunny path, 26. vii., 1 ♂.

speaking of all that is done and has been done during many years for the care and health of animals by the great London Society, and in doing this, for the education and happiness of our people. But the change of which I have spoken is most deeply impressed on those who remember, as many of us do, the misdirected hours in youth when birds were shot in our gardens and brick traps made to catch them. I feel sure that those who did these things are not essentially different from their children and grandchildren who have grown up in a kinder atmosphere. I must not occupy more time on a subject which to some may seem inappropriate, but it is bound up with education in its true sense—a leading out—and if, as Ray Lankester said at York, and we are all coming to believe, the hidden powers within *are* inherited while the results of their development are *not*, then there is no easing of the burden with the passage of time, but each generation afresh must bear the heavy responsibility of conducting this development in the best way so that its successor may be able to meet the changing and, at this time, the increasing needs. The relationship between the powers within and their development was suggested in arresting words by the late Prof. Scott Holland: 'To say that a man cannot be made good by Act of Parliament is such an obvious truth that people forget what an outrageous lie it is!'

Thoughts on the development of these hidden powers by the educating influence of social environment, suggest the greatest of the problems by which we are faced—the end of international war. Michael Foster, in his Address at Dover in 1899, after speaking of progress in the material of warfare was led to believe that, 'happily, the very greatness of the modern power of destruction is already becoming a bar to its use, and bids fair--may we hope before long?—wholly to put an end to it; in the words of Tacitus, though in another sense, the very preparations for war, through the character which science gives them, make for peace.' And in his concluding pages he expressed the hope that the brotherly meeting between the English and French Associations at Dover and Boulogne might be looked upon as a sign that science, by nobler means than the development of armaments, was steadily working towards the same great end. And, in a time of still greater need and perplexity, may we not, in the same hopeful spirit, look upon the recent visit by which members of the French Association have honoured us, and feel strengthened in the belief that the great end will be reached.

There are, I know, very many people who look upon the Great War with later wars and rumours of wars as the close of Michael Foster's dream. The words in which Sir Arthur Schuster concluded his address at Manchester in 1915, and Sir Edward Thorpe at Edin-

Phlæobia antennata Brunn. v. Wattenw.

Foot of Mt. Dulit, viii.–22. ix., 3 ♂♂, 2 ♀♀; previously cultivated land, 9–28. viii., 7 ♂♂, 4 ♀♀; old secondary forest, 12. viii., 1 ♂; recent clearing, old secondary forest, 14. viii., 1 ♀. Mt. Dulit, moss forest, 4000 ft., 27. x., 1 ♀, beating. Long Lobang, in shade on wet undergrowth (Jalutong plantation), 28. x., 2 ♂♂, 2 ♀♀. Claudetown, primary white sand forest, wide sunny path, 26. vii., 1 ♂.

Subfamily *Œdipodinæ*.

Trilophidia annulata Thunb.

Foot of Mt. Dulit, old secondary forest, recent clearing and previously cultivated land, 3. viii.–5. ix., 7 ♂♂, 4 ♀♀. Mt. Dulit, moss forest, 4000 ft., at light, 3. x., 1 ♀. R. Kapah, 5. x., 1 ♀. Claudetown, primary white sand forest, wide sunny path, 26. vii., 2 ♂♂, 3 ♀♀.

Subfamily *Pyrgomorphinæ*.

Atractomorpha psittacina de Haan.

Foot of Mt. Dulit, previously cultivated land and old secondary forest, 26. viii.–5. ix., 5 ♂♂, 2 ♀♀. Mt. Dulit, moss forest, 4000 ft., 19. x., 1 ♂, beating. R. Kapah, clearing, 5–7. x., 1 ♂, 2 ♀♀. R. Tinjar between base camp and Rumah Bulan Ding, riverside, 4–12. xi., 1 ♀. Mt. Kalulong, Long Manian, near house by riverside, 8. xi., 1 ♂.

Systella obliqua Walk.

Mt. Dulit, R. Koyan, primary forest, 2500 ft., 16. xi., 1 ♂.

Trigonopteryx hopei Westw.

Foot of Mt. Dulit, old secondary forest, in undergrowth on leaves, 17. ix., 1 ♀. Mt. Dulit, moss forest, 4000 ft., 22. x., 1 ♂. R. Kapah, primary forest, undergrowth, 23–24. ix., 2 ♂♂.

Subfamily *Catantopinæ*.

Gesonia punctifrons Stål.

Foot of Mt. Dulit, previously cultivated land, 18. viii., 1 ♀.

Oxya chinensis Thunb.

Foot of Mt. Dulit, 7–28. viii., 4 ♀♀.

Traulia hosei Will.

Foot of Mt. Dulit, old secondary and primary forest, undergrowth, 9–10. x.. 2 ♀♀. Mt. Dulit, primary forest, 3000 ft., 24. x., 1 ♂; moss forest, clearing, 4000 ft., 27. x., 1 ♂. The male was unknown. The measurements are as follows :—

Length of body 23 mm., of pronotum 5·5 mm., of elytra 15 mm., of hind femora 13 mm.

Traulia azureipennis Serv.

Foot of Mt. Dulit, previously cultivated land, 19–28. viii., 12 ♂♂, 3 ♀♀ ; recent clearing in old secondary forest, 14. viii.–2. x., 6 ♂♂, 4 ♀♀ ; light trap, 23. viii.–26. ix., 2 ♀♀ ; in reed-bed, 3. viii., 1 ♀. Long Lobang, on wet undergrowth, Jalutong plantation, 28. x., 1 ♂. Claudetown, medium shady path, rubber garden, 27. vii., 3 ♂♂, 1 ♀.

Catantops splendens Thunb.

Foot of Mt. Dulit, 13. viii.–3. ix., 1 ♂, 4 ♀♀ ; recent clearing, old secondary forest, 14. viii., 2 ♂♂ ; burning padi-clearing, 13. ix., 1 ♂, 4 ♀♀ ; previously cultivated land, 22–26. viii., 1 ♂, 1 ♀ ; light trap, 26. viii., 1 ♀ ; at light in house, 4. viii., 1 ♀.

Catantops humilis Serv.

Foot of Mt. Dulit, 19. viii.–3. ix., 4 ♂♂, 2 ♀♀ ; previously cultivated land, 19–28. viii., 6 ♂♂, 4 ♀♀ ; burning padi-clearing, 13. ix., 1 ♀, 2 ♂♂ ; light, 3. x., 1 ♀ ; light trap 5, 26. ix., 1 ♂ ; recent clearing in old secondary forest, 29. viii., 1 ♂.

Patanga succincta Linn.

Foot of Mt. Dulit, 28. viii., 1 ♂.

Patanga luteicornis Serv.

Foot of Mt. Dulit, 9. viii., 1 ♂.

COLORACRIS, gen. nov.

Size medium, body robust, rugosely punctate. Antennæ filiform, reaching far behind the posterior margin of pronotum. Head thick, face slightly reclinate ; frontal

ridge only indicated between the antennæ and projected there. Face, like the rest of the head, rugosely punctured. Lateral facial keels only indicated near the eye, subobliterate, slightly curved. Fastigium of vertex sloping, hexagonal, margins obtuse, forming with the frontal ridge a rounded angle, narrowed between the eyes. Occiput convex without median carinula. Eyes strongly prominent sideways, globose, interocular distance in the female as broad as the first antennal joint, in the male somewhat shorter. Pronotum cylindrical, anterior margin slightly rounded, posterior margin broadly rounded; median keel indistinct or absent, lateral keels absent, submarginal sulcus only distinct on the lateral lobes, first transverse sulcus only distinct on the disc, second and third transverse sulcus distinct both on the disc and on the lobes, third transverse sulcus far behind the middle. Lateral lobes about as long as high, lower margin ascendant from its middle to the anterior margin, likewise to the posterior margin but in less degree, anterior and posterior angle rounded; posterior margin nearly straight or slightly convex. Prosternal tubercle short, conical, sharply pointed. Mesosternal lobes broader than long, their inner margin convex, their interspace broader than long; metasternal lobes separated, especially in the female. Elytra and wings reaching the top of abdomen. Elytra with dense reticulation, anterior and posterior margin nearly parallel, slightly narrowing towards the apex, apex rounded. Wings subcycloid. Hind femora short, rather thick, carinæ subserrate, nearly smooth; knee-lobes rounded. Hind tibiæ slightly curved, not expanded apically, with 9 inner and 6 outer spines, without outer apical spine. Hind tarsi short, not extending beyond the middle of hind tibia; second joint much shorter than the first one, third joint about as long as the two others together.

♂. Supra-anal plate triangular, apex rounded, with a triangular basal impression and an impression on each side of its surface. Cerci reaching a little beyond the supra-anal plate, nearly straight, slightly dilated towards the apex, near the apex with a tooth on the inner side, apex obtuse. Subgenital plate short, obtuse.

♀. Supra-anal plate triangular, apex obtuse. Cerci short, conical, not reaching beyond the supra-anal plate, apex obtuse. Valves of ovipositor short, apex hooked,

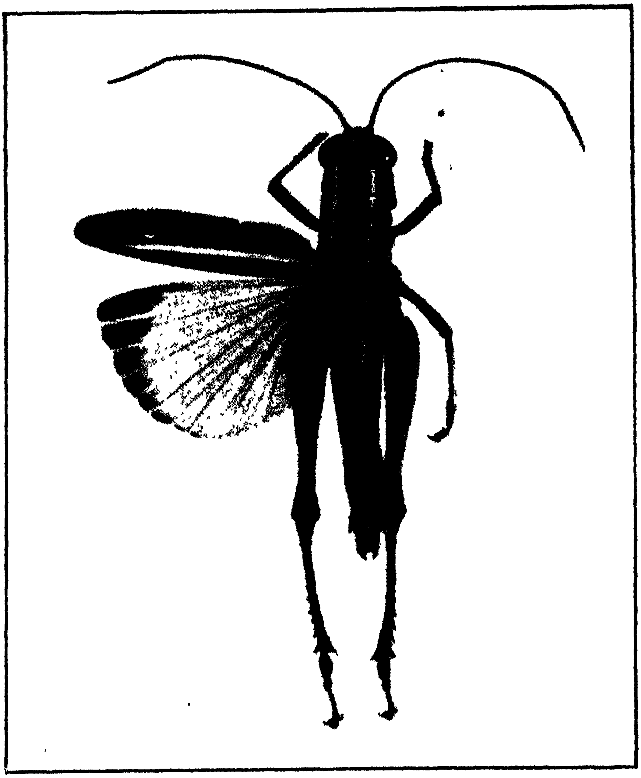
margin obtuse. Subgenital plate longer than broad, posterior margin obtuse angulate.

Genotype : *Coloracris cærulescens*, sp. n.

Coloracris cærulescens, sp. n.

♂♀. General coloration black with yellow. Antennæ black, basal joints yellowish brown, apical joint yellowish. Head black, fastigium of vertex yellow, occiput with

Fig. 7.



Coloracris cærulescens, sp. n., ♀, type.

two narrow longitudinal yellow stripes, continuing on the sides of the pronotum and terminating in the longitudinal yellow stripe in the middle of the elytra. Face black, with a yellow spot below the frontal ridge

and a yellow spot on each side near the clypeal margin. A yellow longitudinal stripe runs from the base of antennæ along the lower margin of the eye, across the cheek, crossing the middle of lateral lobes of pronotum, and terminating on the epimerum of meso- and metathorax. Labrum with a yellow spot on each side, mandibles with two yellow spots. Palpi yellow. Pronotum black with a narrow longitudinal yellow stripe on each side of the disc; lateral lobes with a narrow transverse yellow stripe in the middle. Elytra brownish black, with a longitudinal yellow stripe in the middle along the anal vein. Wings bluish, with the apex infumated and a small blackish stripe bordering the posterior margin, reaching backwards only to the middle of the posterior margin. Anterior and median legs olivaceous-green, coxæ with insertion black with yellow spots, tarsi brown, with a yellowish-brown stripe from above. Hind femora coral-red, area infero interna dirty yellow; knee black, with an indication of a lighter-coloured red prægenicular ring. Hind tibiæ and tarsi blackish brown, spines black. Epimerum of pro-, meso-, and metathorax yellow. Sternum black with symmetrical yellow spots. Abdomen black, sternites with a row of yellow spots in the middle, margins of tergites bordered with yellow, from above with a yellow stripe in the middle or on each side Valves of ovipositor yellowish brown. (Fig. 7.)

	♂.	♀.
Length of body	23 mm.	26 mm.
„ pronotum ..	5	6
„ elytra	15	18·5
„ hind femora.	13	17

[Baram River, Leppu Aga, 1 ♀ (type), 1 ♂ (coll. mea); Sarawak distr., E. Mjöberg, 1 ♀ (coll. Mus. Stockholm)]; Mt. Dulit, primary forest, 2500 ft., 6. x., 1 ♀*.

Coloracris azureus, sp. n.

♀. General coloration reddish brown with yellow. Antennæ black, basal joints olivaceous-green, apical

* This female does not agree in all features with the type. The anterior and median legs are more yellowish red, the hind femora, instead of coral-red, are yellowish red also. For all other features there is no difference.

joints yellowish white. Head olivaceous-green, apex of fastigium of vertex olivaceous-green, posterior part yellow; occiput dark olivaceous-green with two longitudinal yellow stripes beginning on the fastigium of vertex, continuing on the sides of the occiput, along the sides

Fig. 8.

Coloracris azureus, sp. n., ♀, typo.

of the disc of pronotum, and terminating in the longitudinal yellow stripe in the middle of the elytra. Face olivaceous-green with indistinct yellow spots. A yellow longitudinal stripe running from the base of antennæ along the lower margin of the eye, across the cheek, crossing the lower part of the lateral lobe of pronotum, and terminating in the posterior margin of lateral lobes.

Clypeus, labrum, and mandible olivaceous-green with some irregular yellow spots. Palpi brownish black. Pronotum dark carmine-red in the middle of the disc, bordered by the yellow longitudinal stripes on each side; lateral lobes carmine-red with a yellow longitudinal stripe in the lower part. Elytra reaching the apex of hind femora, bluish with a yellowish stripe along the anal vein from base to apex. Wings azureous blue, without black along the posterior margin. Anterior and median legs olivaceous-green, coxæ more yellowish brown. Hind femora dark carmine-red, arc. genic. sup. somewhat blackish. Hind tibiæ bluish, spines with black tips. Epimerum of meso- and metathorax carmine-red. Sternum yellowish brown, partly bordered with carmine-red. Abdomen yellowish brown, with a longitudinal dark stripe from above and on the sides. Valves of ovipositor brown. (Fig. 8.)

♀. Length of body 28 mm., of pronotum 5·5 mm., of elytra 17 mm., of hind femora 17 mm.

♂. Unknown.

Mt. Dulit, R. Koyon, primary forest, 2500 ft., beating, 20. xi., 1 ♀ (type).

Coloracris viridis, sp. n.

♀. General coloration olivaceous-green. Antennæ missing, except basal joints which are black. Head olivaceous-green, fastigium of vertex yellow; occiput with two narrow longitudinal yellow stripes on each side, beginning behind the eyes and continuing on the sides of the disc of pronotum, terminating in the longitudinal stripe in the middle of elytra. Face dark olivaceous-green, with a yellow spot below the frontal ridge and a yellow spot on each side near the clypeal margin. A yellow longitudinal stripe running from the base of antennæ, along the lower margin of the eye, across the cheek, crossing the lower part of lateral lobes of pronotum and terminating on the epimerum of meso- and metathorax. Labrum with three yellow spots, mandibles with two yellow spots. Palpi yellowish. Pronotum dark olivaceous-green, with a yellow longitudinal stripe on each side of the disc, lateral lobes with a yellow transverse stripe in the lower part. Elytra relatively short, only extending a little beyond the

middle of hind femora, olivaceous-green or brown, with a longitudinal yellow stripe along the anal vein. Wings pale bluish without black along the posterior margin; with a yellowish stripe along the radial vein. Anterior

Fig. 9.

Coloracris viridis, sp. n., ♀, type.

and median legs olivaceous-green, coxæ yellowish brown. Hind femora olivaceous-green, inner area more yellowish, knee reddish brown. Hind tibiæ bluish green, spines with black tips. Hind tarsi reddish brown, first joint

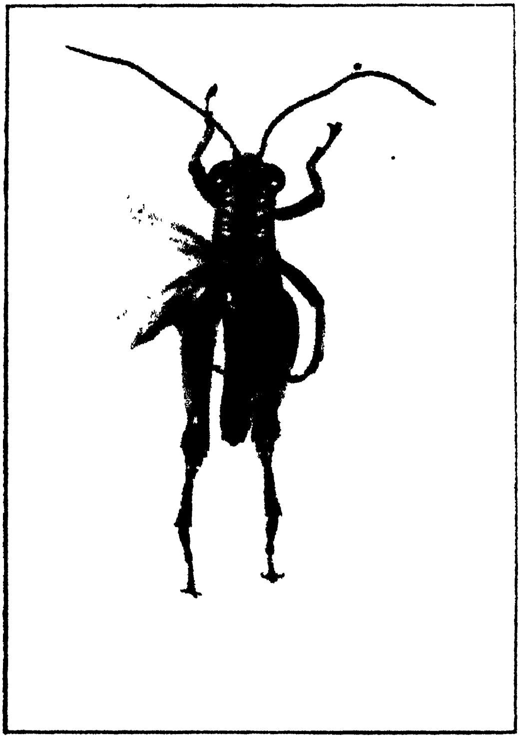
with a black stripe from above. Sternum and abdomen yellowish brown, sides of abdomen brown with a longitudinal yellowish stripe on each side from above. Valves of ovipositor brown. (Fig. 9.)

♀. Length of body 29 mm., of pronotum 6 mm., of elytra 14·5 mm., of hind femora 17 mm.

♂. Unknown.

Mt. Dulit, moss forest, 4000 ft., 22. x., 1 ♀ (type).

Fig. 10.



Phalaca sarawakensis, sp. n., ♂, type.

Phalaca sarawakensis, sp. n

♂. General coloration yellowish brown. Antennæ black, basal and apical joints yellowish brown. Head

yellowish, clypeal margin brownish, fastigium of vertex and occiput with a dark brown stripe in the middle, continuing on the middle of the disc of pronotum. Post-ocular fasciæ brown or blackish brown. Pronotum yellowish brown, disc with a median brown longitudinal stripe, lateral lobes with a transverse brown stripe in the upper part, both reaching from the anterior to the posterior margin ; lower margin of lateral lobe brown in the middle. Elytra reaching the top of abdomen, uniform yellowish brown, relatively narrow, apex broadly rounded. Wings subhyaline. Episternum of meso- and metathorax yellow. Anterior and median legs yellowish brown. Hind femora yellowish brown ; hind knee brown, arcus genicularis black. Hind tibiæ yellowish brown, somewhat darker apically, spines with black tips. Hind tarsi yellowish brown, first and second segment black from above. (Fig. 10.)

♂. Length of body 21 mm., of pronotum 5·5 mm., of elytra 12·5 mm., of hind femora 12 mm.

♀. Unknown.

Mt. Dulit, moss forest, 4000 ft., beating, 27. x., 1 ♂ (type). Foot of Mt. Dulit, previously cultivated land, 19 & 26. viii., 2 ♂♂ ; recent clearing in old secondary forest, 29. viii., 1 ♀.

Pareuthymia obscura, sp. n.

♀. General coloration blackish brown. Antennæ blackish brown, basal joint brown. Head and pronotum rugosely punctured, except the middle of occiput and sides of vertex which are nearly smooth. Head blackish brown with more or less regular blackish spots. Pronotum with a rounded incision in the middle of anterior margin, posterior margin rounded angulate, sulci distinct, both on the disc and on the lobes, except the anterior sulcus that is only indicated on the disc, third sulcus behind the middle ; lateral lobes about as long as broad, lower margin slightly concave in the anterior half, anterior angle acute, posterior angle angulately rounded. Pronotum brown with irregular blackish spots and rows of points, both on the disc and on the lobes. Elytra relatively broad, apex rounded, brown with 3–4 irregular

burgh in 1921, indicate, I hope, that the British Association does not thus despair, and in this belief I bring before you a passage from the far earlier address which Sir Richard Owen delivered to the Twenty-eighth Meeting at Leeds in 1858—a passage which makes a special appeal at a time when the British and American Associations are confidently hoping to strengthen still further the bonds of sympathy and mutual appreciation by which they have been happily united for so many years.

Referring to the transatlantic telegraph Sir Richard said :

'We may confidently hope that this and other applications of pure science will tend to abolish wars over the whole earth ; so that men may come to look back upon the trial of battle between misunderstanding nations, as a sign of a past state of comparative barbarism ; just as we look back from our present phase of civilisation in England upon the old border warfare.'

Confident words inspired by the forging of a new link between the two great English-speaking nations. Nearly eighty years have passed since they were spoken, but with all the terrible disappointments there has been great progress, and a time will surely come, and may it come quickly, a time which shall prove that the visions of the young and the dreams of the old were prophetic of a glorious reality.

transverse bands of blackish-brown colour especially in the apical half. Wings subcycloid, greenish brown, apex and posterior margin very broadly infumated. Insertion of the coxæ brown. Anterior and median legs brown,

Fig. 11.

Pareuthymia obscura, sp. n., ♀, type

variegated with blackish-brown spots. Hind femora yellowish brown, outer area with two blackish brown transverse bands, lower and inner area yellowish brown,

with longitudinal blackish stripes, knee blackish brown. Hind tibiæ yellowish brown, from below and near the apex blackish, spines with black tips. Hind tarsi yellowish brown, first and second segment blackish from above. Sternum and abdomen blackish brown. Supra-anal plate long, triangular, with a median longitudinal sulcus from base to apex. Cerci short, straight, conical, more or less pointed. Valves of ovipositor long and slender, margins smooth, apex slightly hooked, upper valves somewhat broader than the lower ones. Sub-genital plate somewhat longer than broad, posterior margin triangularly excised on both sides and with a large triangular projection in the middle. (Fig. 11.)

♀. Length of body 39 mm., of pronotum 7 mm., of elytra 23 mm., of hind femora 19 mm.

♂. Unknown.

Mt. Dulit, moss forest, 4000 ft., 28. x., 1 ♀ (type).

THREE NEW MEMBRACIDAE FROM BORNEO

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(University of Kentucky)

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PLATE III.

Through the courtesy of Mr. W. E. China, of the British Museum (Natural History), and Dr. B. M. Hobby, of the Hope Department of Entomology, Oxford University Museum, the writer has had the privilege of examining an interesting collection of Membracidae taken on the Island of Borneo.

The collection contains three new species which are here described as follows:—

1. **Maguva brunnea** sp. nov. (Plate III, Fig. 1).

Large, brown, punctate; heavy yellow tomentose patches on sides of thorax, base of scutellum and base of posterior process; suprahumeral horns strong, sharp, projecting directly laterad, as long as the distance between their bases; posterior process slender, sinuate, extending beyond internal angles of tegmina; tegmina smoky hyaline; legs and undersurface of body dark brown

Technical description: Head subquadrate, only slightly wider than long, very dark brown, finely punctate, sparingly pubescent; base highly arcuate and slightly sinuate; eyes large, dark brown; ocelli large, prominent, red, situated slightly above a line drawn through centres of eyes and equidistant from each other and from the eyes; inferior margins of genae sinuate; clypeus twice as long as wide, projecting for three-fourths of its length below inferior margins of genae, tip broadly truncate and weakly pilose.

Pronotum dark brown, finely punctate, sparingly pubescent, with a heavy tomentose orange-yellow patch on the base of the posterior process; metopidium sloping, higher than wide; humeral angles heavy, blunt, triangular; suprahumeral horns strong, triquetrate, sharp, extending directly outward, as long as the distance between their bases; median carina strongly percurrent; posterior process slender, tectiform, strongly sinuate, tip sharp and reaching beyond internal angles of tegmina; scutellum entirely exposed, base tomentose, tip truncate and slightly upcurved.

Tegmina smoky hyaline; base and proximal costal margin coriaceous, dark brown and punctate; apical veins strongly curved; apical limbus very narrow; five apical and three discoidal cells.

Sides of thorax densely yellow tomentose; under surface of body dark brown; legs uniformly dark brown.

Length from front of head to tips of tegmina 7.3 mm.; width between tips of suprahumeral horns 4.4 mm.

Type : Female.

Type locality : Mt. Dulit, Sarawak. Altitude 4,000 feet in moss forest.

Described from two specimens, both females, the holotype taken on October 25th, 1932, and bearing the label 'Beaten from trees,' and the other from Mt. Kukulong, Sarawak, taken in the moss forest at an elevation of 5,000 feet on November 3rd, 1932. Both specimens were taken by B. M. Hobby and A. W. Moore on the Oxford University Expedition. Type and paratype in the British Museum (Natural History).

2. **Pantaleon bulbosus** sp. nov. (Plate III, Fig. 2).

Large, heavy-bodied, dark brown, coarsely punctate, sparingly pubescent; middle of dorsum elevated in a rounded bulbous node; suprahumerals broadly and bluntly auriculate; posterior process short, heavy, extending just beyond internal angles of tegmina; tegmina dark brown, translucent; legs and undersurface of body dark brown.

Technical description : Head obovate, wider than high, dark brown, finely punctate, densely pubescent; base arcuate and strongly sinuate; eyes small, black; ocelli large, prominent, amber-coloured, farther from each other than from the eyes and situated well above a line drawn through centres of eyes; clypeus short, blunt, triangular, truncate apex projecting only very slightly below inferior margins of genae.

Pronotum dark brown, coarsely punctate, sparingly pubescent; metopidium sloping, wider than high; humeral angles small, inconspicuous, rounded; suprahumerals extended outward in heavy, bulbous auriculate projections with blunt and rounded tips; median carina feebly percurrent; centre of dorsum elevated in a heavy bulbous hump; posterior process short, tectiform, decurved, blunt, reaching just beyond internal angles of tegmina; scutellum entirely hidden.

Tegmina short, broad, dark reddish-brown, translucent; base narrowly dark brown, opaque, coriaceous and punctate; apical limbus broad; five apical and two discoidal cells; veins of apical area strongly curved.

Sides of thorax and undersurface of body dark brown; legs uniformly dark brown.

FIG. 1.

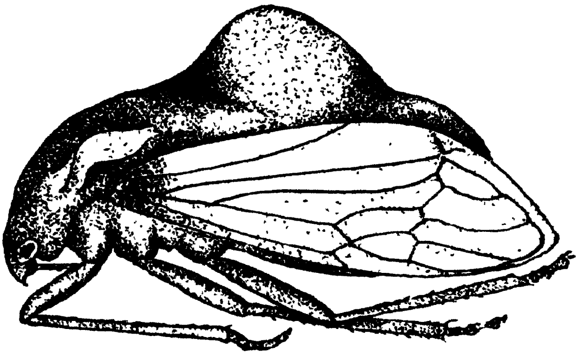

FIG. 2.

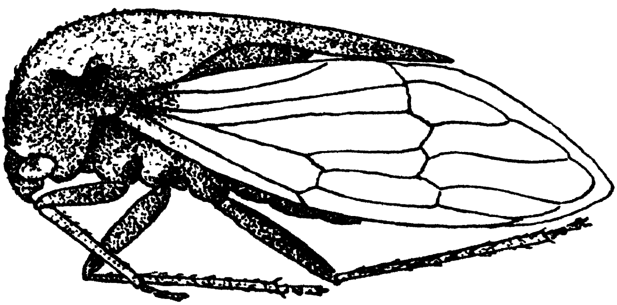

FIG. 3.

NEW MEMBRACIDAE FROM BORNEO

FIG. 1.—*Maguva brunnea* sp. nov.
,, 2.—*Pantaleon bulbosus* sp. nov.
,, 3.—*Tricentrus dyaki* sp. nov.

Length from front of head to tips of tegmina 6.4 mm.; width between extremities of suprahumeral protuberances 3.8 mm.

Type: Female.

Type locality: Kuching, Sarawak.

Described from a single specimen taken by a Dyak collector on August 25th, 1899, and presented to the Oxford Museum by the late Robert Shelford.

Type in Oxford University collection.

3. **Tricentrus dyaki** sp. nov. (Plate III, Fig. 3).

Body large, heavy, reddish-brown, finely punctate, very densely pilose with long golden hairs; suprahumeral horns very short, not reaching outward as far as the humeral angles; posterior process slender, sharp, reaching just beyond internal angles of tegmina; tegmina wrinkled, hyaline; undersurface of body brown; legs bright ferrugineous-brown.

Technical description. Head subquadrangular, twice as wide as long, finely punctate, densely pubescent; base strongly arcuate and feebly sinuate; eyes large, light brown, extending outward as far as the humeral angles; ocelli large, fuscous-brown, prominent, equidistant from each other and from the eyes and situated slightly above a line drawn through centres of eyes; inferior margins of genae sinuate and flanged; clypeus heavy, twice as long as wide, notched on each side just below margins of genae, extending for two-thirds its length below margin of face, tip broadly rounded and pilose.

Pronotum bright reddish-brown, finely punctate, densely pubescent with golden hairs; metopidium sloping, wider than high; median carina obsolete; humeral angles strong, blunt, triangular; suprahumeral horns short, triangular, sharp, flattened dorso-ventrally, only about one-fourth as long as the distance between their bases, extending directly laterad but not quite as far as the humeral angles; posterior process slender, tectiform, triquetrate, tip sharp and extending just beyond internal angles of tegmina; scutellum broadly exposed on each side.

Tegmina wrinkled hyaline; base narrowly brown, coriaceous and punctate; apical limbus broad; five apical and three discoidal veins.

Sides of thorax and undersurface of body brown; proximal two-thirds of femora brown; distal third of femora and all of tibiae and tarsi bright ferruginous brown.

Length from front of head to tips of tegmina 7 mm.; width between tips of suprahumeral horns 3.7 mm.

Type: Male.

Type locality: Kuching, Sarawak.

Described from a single specimen taken by a Dyak collector on July 17th, 1900, on a flowering tree and presented to the Oxford Museum by the late Robert Shelford.

Type in Oxford University collection.

University of Kentucky,
Lexington, U.S.A.
March 24th, 1937.

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RESULTS OF THE OXFORD UNIVERSITY EXPEDITION TO SARAWAK (BORNEO), 1932.—GYRINIDEN (COLEOPTERA).

Results of the Oxford University Expedition to Sarawak (Borneo), 1932.—*Gyriniden (Coleoptera).* Von Georg Ochs, Frankfurt a. Main.

[Plate XVIII.]

In meiner Arbeit von 1928 (Ent. Bl. xxiv. pp. 41–45, 78–85, 98–103) hatte ich den Versuch gewagt, die Gyriniden von Borneo erstmalig zusammenfassend zu bearbeiten. Über die gleiche Fauna habe ich 1930 (Ent. Bl. xxvi. p. 17) einige zusätzliche Angaben gemacht und einen weiteren Nachtrag 1932 (Ent. Bl. xxviii. pp. 172–175) veröffentlicht.

Inzwischen ist mir durch die gütige Vermittlung des Sir Guy A. K. Marshall, Imperial Institute of Entomology in London, von Dr. B. M. Hobby, Hope Department of Entomology, Oxford University, die umfangreiche Gyriniden-Ausbeute zugegangen, welche von der Oxford University Expedition to Borneo 1932 unter seiner Leitung zusammengebracht worden ist. Gleichzeitig stellte mir Herr Dr. Delkeskamp einschlägiges Material aus dem Zoologischen Museum der Universität Berlin zur Verfügung. Den beteiligten Herren möchte ich hierdurch nochmals meinen besten Dank für die bewiesene Gefälligkeit abstatten, ebenso den Herren Dr. Masi in Genua, G. E. Bryant in London und E. Banks in Kuching (Sarawak) für freundlichst übermittelte Aufklärungen und Literatur über Fundorte, und Dr. W. Alt in Frankfurt a. Main für die photographische Wiedergabe des Oedeagus von *O. seminitens*.

Bei der Bearbeitung dieses neuen Materials war es notwendig, die von früher bekannten Arten zum Vergleich heranzuziehen und nochmals genau zu prüfen, wobei sich zeigte, dass die älteren Feststellungen vielfach einer Korrektur bedürftig waren. Es ergab sich ferner, dass es notwendig war, über die Lage der Fundorte Klarheit zu gewinnen, um hierdurch Anhaltspunkte für die systematische Einschätzung der oft sehr nahestehenden Formen zu gewinnen.

Die ersten Arten, welche Régimbart 1882 (Ann. Mus. Stor. nat. Genova, xviii. pp. 72–74) aus Borneo beschrieben hat, entstammten den Ausbeuten von Marquis Doria und Dr. Beccari, die betreffenden Belegestücke befinden sich im Museum in Genua. Dr. Masi hatte die Güte,

mir hierzu folgendes mitzuteilen : " Les insectes furent récoltés dans les alentours de Kuching, le Marquis Doria ne s'étant pas éloigné de ces endroits, ou bien dans la région Sarawak par M. Beccari remontant la rivière Butang, ou en excursion jusqu'au mont Matang." Die genauen Fundorte sind bei den einzelnen Arten leider nicht angegeben, auf alle Fälle stammen diese Exemplare sämtlich aus Süd-Sarawak. Im Gegensatz dazu kommt die Mehrzahl der Arten, welche derselbe Autor 1907 (Ann. Soc. Ent. Fr. lxxvi. pp. 192–221) anführt, vom Berg Kinabalu auf der N.-O. Spitze der Insel, wo eine von den Süd-Sarawak-Arten sehr verschiedene Fauna lebt. Für einige Arten ist Brunei als Herkunft angegeben, diese werden gleichzeitig vom Kinabalu gemeldet. Dagegen trägt die Arten-Zusammensetzung von Pontianak (Westküste), von wo Régimbart eine Ausbeute vorgelegen hat, einen besonderen Charakter und scheint sich an die Süd-Sarawak-Fauna anzulehnen.

Aus dem Nordosten der Insel (Kinabalu) stammt gleichfalls der grössere Teil des von mir 1928, 1929 und 1932 behandelten Materials, zweifellos sind wir über die Gyriniden-Fauna dieses Abschnitts am besten informiert. Gleichzeitig konnten jedoch in der Arbeit von 1928 auf Grund der Bearbeitung der interessanten Bestände des Sarawak-Museums (welche leider auf dem Rücktransport in Verlust geraten zu sein scheinen) zahlreiche Neumeldungen aus den südlich anschliessenden Gebieten erfolgen : Trusan river, Lawas river, Mt. Murud, Lio Matu, Baram river, Mt. Dulit ; ebenso aus dem Süd-Sarawak-Gebiet : Kalinkang Mts. mit Mt. Lingga im Osten (hier entspringt der Strap river) und Mt. Merinjak im Westen, Mt. Penrissen (am Südfuss desselben der Fundort P. Amkat) und Mt. Matang. Von Mt. Dulit stammt auch die hierunter behandelte Ausbeute der Oxford University Expedition ; im Zool. Anz. cvii. (1934), pp. 202–214, bespricht Falkenström eine Ausbeute vom Mt. Tibang (Museum Stockholm).

Die Mehrzahl der vorerwähnten Lokalitäten sind auf einer Karte zu finden, welche einer faunistischen Arbeit über Säugetiere und Vögel von Banks (1933, Proc. Zool. Soc. Lond. 1933, pp. 273–282) beigefügt ist. Banks unterteilt in dieser Abhandlung die Insel in mehrere Faunenbezirke, doch scheinen bei den Gyriniden die Verhältnisse etwas anders zu liegen. Bei dieser Familie ist es kaum

möglich, die Bewohnerschaft des nördlichen Bezirks und der " intermediate area " von Banks zu trennen, da sie zahlreiche Arten mit einander gemeinsam haben. Dasselbe trifft zu für die südlich anschliessenden Ketten der Nieuwenhuis- (Mt. Tibang), Müller- und Schwaner-Gebirge, so dass die gesamte Zentralkette, die das Rückgrat der Insel ausmacht, eine im Grund einheitliche Gyriniden-Fauna besitzt. Eine stark abweichende Arten-Zusammensetzung findet sich dagegen im Gebiet der isolierten Gebirgsstöcke in Süd-Sarawak (Kalinkang, Penrissen, Matang) ; unter Hinzurechnung der von Régimbart (*l. c.* 1907) von Pontianak gemeldeten Arten sind von 9 dort nachgewiesenen Arten 7 endemisch. Sehr arm an Gyriniden scheint der südlich der Zentralkette gelegene Teil der Insel zu sein ; von dort sind bisher nur die beiden *Dineutus*-Arten bekannt, die gleichzeitig in anderen Teilen der Insel und auch ausserhalb Borneos vorkommen, dagegen kein einziger *Orectochilus*. Vielleicht ist dieses weite Gebiet noch zu wenig besammelt, zum mindesten an den Oberläufen der hier entwässernden Flüsse müsste sicher mit einer grösseren Artenfülle zu rechnen sein.

Was die vertikale Verbreitung anbelangt, so scheint in Borneo bei rund 3000′ Seehöhe eine scharfe Faunengrenze zu liegen, im Zusammenhang wohl mit klimatischen Verhältnissen, die äusserlich in der plötzlichen Ablösung des Tropen-Urwaldes durch den im Charakter gänzlich verschiedenen Mooswald ihren Ausdruck finden. Diesbezügliche Schilderungen im Zusammenhang mit Fundorten von denen wir Gyriniden besitzen finden sich in folgenden Aufsätzen : H. M. Pendlebury und F. N. Chasen, 1932, J. F.M.S. Mus. xvii. pp. 1–38 (Kinabalu) ; T. H. Harrisson, 1933, Geogr. J. lxxxii. pp. 385–410 (Mt. Dulit) ; G. E. Bryant, 1919, Ent. Mon. Mag. lv. pp. 70–76 (Süd-Sarawak). Banks spricht daher von einer Montan-Fauna über 3000′ Seehöhe.

Soweit bei dem bis jetzt vorliegenden Material exakte Höhenangaben existieren, scheinen sich die Gyriniden—zum mindesten als Imago—nicht an diese Grenze zu halten, da zahlreiche Arten sowohl oberhalb als unterhalb gleichzeitig gefunden wurden. Bei einigen von ihnen (z. B. *O. longulus*, *subsinuatus*, *crassipes*) überwiegen Funde aus höheren Lagen, die sie vorzuziehen scheinen. Der Anteil der Arten, die nur unter 3000′ erbeutet wurden, beträgt noch nicht 50 % ; unter ihnen befinden sich

ausnahmslos die wenigen Arten, welche Borneo mit Nachbarfaunen gemeinsam hat (*D. spinosus, marginatus, O. productus, corniger*). Bei mehreren Arten bemerkt man die Tendenz, in höheren Lagen kräftigere Rassen zu bilden (*D. marginatus mjöbergi, O. mjöbergi, angulatus, castaneus*), gleichzeitig finden wir an den höheren Gebirgsstocken isolierte Arten, die teilweise mit weiter verbreiteten Arten eng verwandt sind (aus Rassenbildung hervorgegangen ?), teilweise auf anderen Bergen durch ähnliche Arten ersetzt werden (Vikarianten ?).

Alles in allem scheinen die Gyriniden—besonders die den Hauptteil der Fauna Borneos ausmachenden *Orectochilus*-Arten—an die höheren Gebirge gebunden zu sein, da nur von deren Abhängen namhafte Funde vorliegen und die höchsten Erhebungen die grösste Artenfülle aufzuweisen haben. Es ist daher anzunehmen, dass diese Insekten dort ihre günstigsten Daseinsbedingungen vorfinden. Vermutlich spielt hierbei die Menge und Regelmässigkeit der Niederschläge, welche ihre Wohngewässer speisen, die ausschlaggebende Rolle, neben der näheren Beschaffenheit der Wasserläufe (Untergrund, Ufer, Pflanzenwuchs, chemische und thermische Eigenschaften des Wassers, Stömungsverhältnisse und Veränderlichkeit des Wasserspiegels), besonders in Hinblick auf die Bedürfnisse der Larven. Letztere dürften auf speziellere Verhältnisse zugeschnitten sein als die Imagines —nur so ist bei der grossen Beweglichkeit der Käfer, welche schwimmen und fliegen können, die Gebundenheit zahlreicher Arten an ganz bestimmte Lokalitäten hauptsächlich zu erklären—und besonders in den langsam fliessenden, verschlammten und sauerstoffärmeren Flüssen der Ebene, namentlich in ihrer Eigenschaft als Unterwasser-Atmer, weniger gut vorankommen.

Die Gyriniden der Oxford University Expedition stammen aus zwei verschiedenen Fluss-Systemen, u.z.w. entwässert der Koyan river zum Rejang, der Lejok und der Kapah durch den Tinjar zum Baram. Dass die kleine Ausbeute aus dem Koyan eine ganz andere Arten-Zusammensetzung hat als die aus Lejok und Kapah, scheint mir weniger daran zu liegen, dass es sich um ein anderes Fluss-System handelt, sondern weil dieses Gewässer einen ganz anderen Charakter hat. Herr Hobby schreibt mir dazu folgendes: "The Koyan, in the area from which insects were collected, may be divided into two

areas, one a shallow rapid stream flowing evenly over a rocky bed with no outstanding boulders, and the second a wide, deeper and less rapid area or pool. In this, probably, the Gyrinids were taken." Wie aus dem Expeditions-Bericht von Harrisson zu entnehmen ist, ist ausserdem der Einfluss der Gebirgsfauna an dem zum Koyan neigenden Abhang des Dulit-Gebirges grösser als in gleicher Höhenlage am Abhang zum Tinjar. Am Koyan wurden erbeutet *O. laticinctus*, welcher vom Kinabalu (1500 m.) bekannt ist, *O. seminitens*, dessen nächster Verwandter am Mt. Tibang erbeutet wurde, und *O. pusillus* (?), der sich mit Exemplaren, die mir früher aus Süd-Sarawak (P. Amkat) vorgelegen haben, zu decken scheint.

Am Lejok wurde im Gebiet des Mooswaldes gesammelt. In diesen höheren Lagen fanden sich *O. dispar* und *subsinuatus*, letzterer anscheinend die dominierende Art. Das Tagebuch des Herrn Ford sagt dazu: "Gyrinids—above the falls in fairly still water, under rock ledges." Weiter unten ist die Auswahl der Arten grösser: *O. dispar*, *semirufus*, *dulitensis*, *castaneus*, *subsinuatus* (vereinzelt) und *biformis*, in dem erwähnten Tagebuch wird dazu gesagt: "Gyrinids—swimming in sheltered spot, Lejok river, 850 ft. Occurring up to foot of large waterfall (1750 ft.)." Herr Hobby schreibt ferner: "The Lejok in the region in which the latter were collected is a swift torrent, liable to frequent floods [der Tinjar kann nach Harrisson's Bericht in einer Nacht 40 Fuss steigen !]. The bed is very rough and water runs rapidly between large boulders, the latter breaking up the current and in some places causing shelter, where water is comparatively still—in such places these beetles occur. Above the falls the stream flows fairly evenly, though there are large pools of still water. In general, however, most surface insects on the top of Dulit are to be found in the numerous small streams which join together to form the Lejok, *e. g.* adult Hydrometridæ (Heteroptera) were only found in these streams, though nymphs occurred in the main stream and probably were frequently swept over the falls."

Die Gyrinidenfauna des Mt. Dulit ist nach der des Mt. Kinabalu wohl dis bis jetzt am besten bekannte von ganz Borneo, denn die Ausbeute der Oxford University

Expedition ergänzt sich auf das Beste mit der früher von mir bearbeiteten des Dr. Mjöberg, der seinen Aufstieg ebenfalls an der zum Tinjar neigenden Seite, aber etwas weiter flussabwärts bewerkstelligt hat. Zum Teil wurden daher auch die gleichen Arten erbeutet, bei der Oxford-Ausbeute kommt *O. biformis* als neue Art hinzu, dagegen fehlt leider der interessante *D. marginatus mjöbergi*. Von den gesammelten *Orectochilus*-Arten haben *O. dispar* und *castaneus* eine weitere Verbreitung, vermutlich sind diese in der ganzen Zentralkette zu finden. *O. semirufus* ist eine Lokalform, deren Verwandte in Süd-Sarawak leben. *O. biformis* hat Verwandte in Süd-Sarawak und am Kinabalu, *O. dulitensis* und *subsinuatus* werden am Kinabalu durch ähnliche Formen bezw. Arten ersetzt, jedenfalls sind also die Beziehungen der Gyriniden-Fauna des Mt. Dulit zu der von Süd-Sarawak geringer als zu der von Kinabalu.

Die Reihenfolge der nachstehend besprochenen Arten habe ich wie in den früheren Arbeiten belassen, obgleich vielleicht versucht werden sollte, dieselben ihren Abstammungsverhältnissen und mutmaasslichen phylogenetischen Alter nach zu gruppieren. Ich muss indessen gestehen, dass ich in dieser Beziehung bei *Orectochilus* noch wenig klar sehe.

Orectochilus dispar Rég.

Orectochilus dispar Rég., 1907. Ann. Soc. Ent. Fr. lxxvi. p. 192.
Orectochilus dispar Ochs, 1928, Ent. Bl. xxiv. p. 79.
Orectochilus dispar Falkenstrom, 1934, Zool. Anz. cvii. p. 204.

Dulit trail, 22. viii. 1932, primitive forest (*Shackleton*), 1 ♀, nur 9 mm. lang.

Foot of Mt. Dulit, junction of rivers Tinjar and Lejok, 22. viii. 1932, Lejok stream, below surface, alt. 850 ft., primitive forest (*Hobby & Moore*), 1 ♂.

10. ix. 1932, under growth, old secondary forest (*Hobby & Moore*), 1 ♀.

River Kapah, tributary of river Tinjar, 24. ix. 1932, primitive forest (*Hobby & Moore*), 1 ♂.

River Lejok, fairly still water, 15. x. 1932, moss forest (*Hobby, Moore, & Ford*), 2 ♀♀.

[*Orectochilus nigricaudatus* Ochs.] *.

Orectochilus crassipes subsp. *nigricaudatus* Ochs, 1932, Ent. Bl. xxviii. p. 172.
Orectochilus coracinus Falkenström, 1934, Zool Anz. cvii. p. 213.

* Die eingeklammerten Arten wurden von der Expedition nicht erbeutet.

In meinem Material haben sich noch einige Stücke vorgefunden, welche infolge mangelhafter Präparation früher nicht erkannt wurden. Es sind Exemplare von 14 mm. Länge dabei, die also dem *O. crassipes* an Grösse nicht nachstehen, und ich glaube jetzt sicher, dass es sich um eine zweite Art handelt, da eine Reihe von Unterscheidungsmerkmalen vorliegen und auch die Wohngebiete sich überschneiden. Die beiden Arten sind leicht zu trennen, wenn der Hinterleib über die Flügeldecken vorragt, da die Tergite bei *O. nigricaudatus* dunkel, bei *O. crassipes* dagegen rot gefärbt sind, ausserdem ist das letzte Abdominal-Segment bei ersterem schmäler. Ferner sind bei *O. nigricaudatus* die Vordertarsen des ♂ schmäler als das Schienenende, bei *O. crassipes* breiter, und die Tomentbinde bei beiden Geschlechtern schmäler. Bei *O. nigricaudatus* reicht dieselbe auf dem Halsschild vorn nur bis zur Augenmitte (bei *crassipes* die ganze Augenbreite erreichend), auf den Flügeldecken ist sie hinten weniger stark verbreitert, trifft weiter aussen auf die schmale Verlängerung zur Naht, läuft daher auf grössere Entfernung mit der Trunkatur parallel und der glatte Raum endigt infolgedessen in einer breiteren verrundeten Spitze. Es trifft ferner zu, was Falkenström zuerst beobachtet hat, dass der Trochanter des Vorderbeins beim ♂ auf der Vorderseite nur eine schmale Furche zeigt, während bei *O. crassipes* diese Furche bedeutend breiter und stärker beborstet ist, ausserdem sind bei letzterer Art die Vorderschienen apikal stärker schräg abgeschnitten. Alles in allem dürfte nach der Beschreibung des *O. coracinus* Falk. letzterer mit meinem *O. nigricaudatus* identisch sein ; die Schwarzfärbung seiner Stücke ist vermutlich individuell, während die mir vorliegenden Exemplare die gleichen Schwankungen in der Färbung aufweisen wie *O. crassipes* in grösseren Serien, *O. nigricaudatus* ist enthalten in den früher unter *O. crassipes* aufgeführten Serien von Kinabalu 1500 m. (*Waterstradt* leg.), Kiau, 25. iii. 1929 (*Pendlebury*), und andres Material ohne genaue Fundortangabe aus den Museen in Dresden und Berlin. Unter letzteren auch einige schwarze Stücke und Uebergänge dazu.

Da Falkenström den immerhin stark verschiedenen *O. corpulentus* Rég. bei der Besprechung seines *O. coracinus* und des *O. dispar* zum nahen Vergleich heranzieht und

von Java erwähnt, sei wiederholt festgestellt, dass diese Art mit Sicherheit bisher nur aus Burma und dessen nächster Nachbarschaft festgestellt ist, und ebenso gewiss weder auf Borneo noch auf Java vorkommt. Man findet diese Art in älteren Sammlungen verstreut mit allen möglichen nicht ernstzunehmenden Fundortbezettlungen, doch soll man es vermeiden, derartige Falschangaben durch kritiklose Wiederholung in der Literatur zu verewigen, zumal wenn entsprechende Korrekturen bereits vorliegen.

Orectochilus mjöbergi semirufus Ochs.

Orectochilus mjöbergi var. *semirufus* Ochs, 1928, Ent. Bl. xxiv. p. 82.
Orectochilus mjöbergi var. *semirufus* Ochs, 1930, Ent. Bl. xxvi. p. 17.

Foot of Mt. Dulit, junction of rivers Tinjar and Lejok, 22. viii. 1932, Lejok stream below surface, alt. 850 ft., primitive forest (*Hobby & Moore*); 4 ♂♂, 3 ♀♀. 22. viii. 1932, cultivated land, now waste (*Hobby & Moore*), 1 ♂.

Völlig identisch mit den früher von Mjöberg am Mt. Dulit erbeuteten Stücken, welche mir zur Beschreibung dienten. Vielleicht artlich von der Nominatform verschieden, denn der Oedeagus ist schlanker, subparallel, apikal flach verrundet, etwa vor der Mitte beiderseitig leicht eingeschnürt, ausserdem eine stärkere Einschnürung im Basalteil, apikal etwa ebensobreit wie das Ende einer Paramere. Bei *O. mjöbergi* vom Mt. Penrissen ist der Oedeagus etwa doppelt so breit und die distale Einschnürung liegt kurz vor dem Apex, ähnlich aber etwas schmäler bei den Stücken von Kaling-Kang und Mt. Lingga, über deren artliche Identität mit der Nominatform man abenfalls im Zweifel sein kann. Die Form *semirufus* ist von dem typischen *mjöbergi* ausser in Grösse und Färbung ferner leicht verschieden durch regelmässiger rundmaschige Retikulierung der Flügeldecken, etwas prononzierteren apikalen Aussenwinkel der Flügeldecken und geradere Innenkante der Seitenbinde des Halschilds. Bei beiden Formen ist beim ♂ das erste Tarsenglied aussen kantig erhöht.

Orectochilus dulitensis Ochs.

Orectochilus dulitensis Ochs, 1928, Ent. Bl. xxiv. p. 82.
(?) *Orectochilus dulitensis* Ochs, 1932, Ent. Bl. xxviii. p. 173.

Foot of Mt. Dulit, junction of rivers Tinjar and Lejok. 22. viii. 1932, Lejok stream, below surface, alt. 850 ft.,

primitive forest (*Hobby & Moore*); 13 Exemplare. 22. viii. 1932, cultivated land, now waste (*Hobby & Moore*), 2 St.

Wie die Typen! Oedeagus lang, subparallel, apikal flach verrundet, im Basaltteil ein stärkere Einschnürung, im Apikalteil kaum eingeschnürt, von oben gesehen etwa so breit wie eine Paramere.

Bei *O. murudensis* Ochs ist der Oedeagus ähnlich, aber der Apex deutlich leicht verbreitert. Bei *O. matruelis* Rég. befindet sich eine Einschnürung im letzten Viertel der Länge, das Ende ist deutlich verbreitert, apikal gerade abgeschnitten und kurz aufgebogen. Bei *O. acutilobus* Rég. ist der Oedeagus pfriemenförmig, etwa so breit wie eine Paramere, in der Mitte kräftig eingeschnürt, Spitze von der Seite gesehen kurz abgesetzt und aufgebogen. Bei *O. palawanensis* Rég. von Binaluan ist die Bildung ähnlich dem letzteren, jedoch viel zierlicher, von der Mitte zum Apex verjüngt, seitlich gesehen nur halb so breit, allmählich in die andeutungsweise S-förmig aufgebogene Spitze verjüngt.

[*Orectochilus palawanensis* Rég.]

Orectochilus palawanensis Rég. 1907, Ann. Soc. Ent. Fr. lxxvi. p. 195.
Orectochilus palawanensis Ochs, 1928, Ent. Bl. xxiv. p. 83.

Ausser den früher bereits erwähnten Exemplaren (*l. c.* 1928): 1 Paratype ♀ von Süd-Palawan und einer kleinen Serie von Nord-Palawan, liegen mir jetzt noch 3 ♂♂ vor, bezettelt " Palawan " aus der Sammlung Moser, jetzt im Zool. Museum der Universität Berlin, und 2 weitere ♂♂ mit Etikette N. Borneo, Kinabalu, gleicher Provenienz. Bei letzteren würde ich ohne weiteres Falschbezettelung annehmen, wenn diese Stücke nicht gleichzeitig im Penisbau etwas von den Palawan-Stücken abweichen würden. Es ist daher nicht ausgeschlossen, dass diese Exemplare tatsächlich von der Hauptinsel stammen (gleiche Etikette tragen Stücke von *O. planiusculus, nigricaudatus* und *crassipes* aus der gleichen Sammlung), ausser der Penisdifferenz kann ich jedoch kaum einen Unterschied feststellen. Wölbung vielleicht etwas geringer, Grösse 8–8¼ mm.

Die 3 Stücke von " Palawan " sind ebenfalls grösser als von Regimbart angegeben und messen 7–8 1/4 mm. Im übrigen entsprechen sie der Urbeschreibung, welche

jedoch unter gleichzeitiger Zugrundlegung der Paratype in meinen Besitz in folgendem ergänzt werden muss: Rotfärbung der Unterseite ergreift auch die Epipleuren und bis zu einem gewissen Grade das ganze Abdomen und die Seiten der Bruststücke; Maschen der Retikulierung auf dem Kopf leicht quer, mehr oder weniger ebenso auf dem Halsschild, auf den Flügeldecken in der Schildchengegend schräggestellt; Tomentbinde an der Basis der Flügeldecken leicht breiter als an der korrespondierenden Stelle des Halsschilds; Seitenrand der Flügeldecken vorn sehr schmal, im letzten Drittel der Länge kräftig nach innen verbreitert; ♀ flacher gewölbt als das ♂; Oedeagus des ♂ von oben gesehen pfriemenförmig, von der Basis zur Spitze allmählich verjüngt, etwa in gleicher Breite wie die Parameren, Basalhälfte auf der Oberseite mit Längsrinne, seitlich gesehen mit aufgebogener Spitze und einer leichten Einschnürung kurz nach der Mitte. Bei den Stücken von N. Borneo etwas kürzer und plumper.

[*Orectochilus palawanensis* subsp. *boettcheri* nov.]

Orectochilus palawanensis Ochs, 1928, Ent. Bl. xxiv. p. 83.

Etwas kürzer und breiter als die Nominatform, die unbehaarten Partien der Oberseite mit Erzschein, Unterseite stärker aufgehellt, ♀ nur wenig flacher als das ♂, letzteres in der Wölbung mehr den Borneo-Stücken entsprechend, Oedeagus viel schlanker und schmaler als bei der Nominatform, apikal höchstens halb so breit als eine Paramere.

Habitat.—Nord-Palawan, Binaluan, xi.–xii. 1913 (*G. Boettcher*).

Typus ♂ und Allotypus ♀, sowie 2 Paratypen in meiner Sammlung.

Orectochilus castaneus Rég.

Orectochilus castaneus Rég. 1907, Ann. Soc. Ent. Fr. lxxvi. p. 199.
Orectochilus castaneus Ochs, 1928, Ent. Bl. xxiv. p. 98.
Orectochilus castaneus Ochs 1932, Ent. Bl. xxviii. p. 174.

Foot of Mt. Dulit, junction of rivers Tinjar and Lejok, 22. viii. 1932, Lejok stream below surface, alt. 850 ft., primitive forest (*Hobby & Moore*), 2 ♂♂.

Der Oedeagus ist ähnlich geformt wie bei *O. subsinuatus* Ochs, länger im Verhältnis zu den Parameren, stärker zugespitzt, seitlich gesehen weniger S-förmig gebogen.

Die von mir 1930, Ent. Bl. xxvi. p. 17, erwähnten Exemplare aus dem Dresdener Museum gehörten nicht zu *O. castaneus*, sondern zu der hierunter neubeschriebenen Art.

Zu den früher (*l. c.* 1928) angegebenen Unterscheidungsmerkmalen gegen *O. staudingeri* kommt hinzu : bedeutend flachere Gestalt ; stärker S-förmig geschweifte Innenkante der Tomentbinde des Halsschilds ; mehr parallelseitiger Oedeagus mit stärker aufgebogener Spitze.

[*Orectochilus planiusculus*, sp. n.]

Orectochilus castaneus Ochs, 1930, Ent. Bl. xxvi. p. 17.

♀.—Long. 5–5½ mm. Oblongo-ovatus, elongatus, postice leviter attenuatus, parum convexus, depressus. Supra nitidus, castaneoferrugineus, ad latera punctato-tomentosus, pubescentia lutea, postice anguste ferrugineo-limbatus ; infra ferrugineus, in medio infuscatus. Labro transversali, supra punctato-piloso, antice arcuato et flavo-ciliato. Clypeo antice leviter emarginato. Reticulatione in regionibus glabris subtilissima, transversa, vix visibili, punctatura minutissima remota. Margine tomentoso in pronoto parum lato, antice latiore, in elytris continuato, post medium fortiter dilatato et suturam ad quintam partem attingente. Spatio lævi in elytris oblongo, postice triangulariter acuminato. Truncatura leviter obliqua, angulo suturali anguste rotundato, externo obtuso distincto. Tibiis anticis apicem versus modice intus dilatatis, antice recte truncatis, angulo apicali externo anguste rotundato ; tarsis apicem versus attenuatis. ♂ ignotus.

Habitat.—N.-O. Borneo (Vermächtnis *Gebr. Müller*).

Typus ♀ in meiner Sammlung, weitere Stücke ebendaselbst und im Museum Dresden, von wo die Type stammf sowie von N. Borneo, Kinabalu, im Zool. Museum der Universität Berlin.

Bisher mit *O. castaneus* Rég. vermengt, mit dem die neue Art ungefähr die gleiche Grösse hat, sie ist aber länglicher von Gestalt und von der Seite gesehen viel flacher, woran leicht erkenntlich. Ausserdem ist die Mikroskulptur der Oberseite viel feiner und die tomentierte Seitenbinde an der Berührungsstelle von Halsschild und Flügeldecken gleichbreit (bei *O. castaneus* auf den Flügeldecken breiter als auf dem Halsschild). Der glatte Raum auf den Flügeldecken reicht weiter nach hinten, die Trunkatur aussen ohne Schweifung.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCES.

NOISE AND THE NATION

ADDRESS BY

G. W. C. KAYE, O.B.E., M.A., D.Sc.,

PRESIDENT OF THE SECTION.

Applied Physics and related Matters.

There is a feeling, which of late years has been gathering strength, that the primary concern of the British Association should be to bring home to the community how much its welfare and its interests owe, and are likely to owe in the future, to science and its developments. Our President at Blackpool last year emphasised this outlook in his address on 'The Impact of Science on Society'; and we in Section A have thought it well this Coronation year to devote the greater part of our proceedings to some of the beneficent influences of applied physics on the complex social and industrial life of the nation. We feel that in

[*Orectochilus planatus*, sp. n.]

Orectochilus staudingeri Ochs, 1930, Ent. Bl. xxvi. p. 17.
Orectochilus staudingeri Ochs, 1932, Ent. Bl. xxviii. p. 174.

Long. 6½–7 mm. Ovatus, elongatus, postice attenuatus, modice convexus. Supra nitidissimus, castaneo-ferrugineus, in capite æenescens, labro et clypeo rufescentibus, ad latera tomentosus, pubescentia aurea ; infra piceo-ferrugineus, abdomine, epipleuris pedibusque rufo-ferrugineis. Labro transversali, antice arcuato et flavo-ciliato, supra punctato-piloso. Clypeo antice recte truncato nec emarginato. Supra in regionibus glabris reticulatus et remote punctatus, reticulatione in capite sat fortiter impressa (areolis leviter transversis), in pronoto multo minus impressa, in elytris subtilissima, transversa et obliqua. Margine tomentoso in pronoto sat lato, post oculos dilatato, in elytris antice paulo latiori, circiter ad medium (in ♀ paulo post medium) fortiter dilatato et suturam ad quintam partem attingente. Spatio lævi elytrorum longe cordiformi, post medium subangulatim constricto, in ♀ magis oblongo, postice acuminato. Truncatura leviter obliqua, angulo suturali leviter rotundato, externo obtuso, haud deleto. Tibiis anticis in ♂ sat robustis, triangularibus, antice recte truncatis, angulo apicali externo rotundato, in ♀ minus dilatatis ; tarsis anterioribus in ♂ dilatatis, oblongis, antice breviter attenuatis, in ♀ minus dilatatis, subparallelis, leviter attenuatis.

Habitat.—Borneo. Kinabalu, Kenokok river, 3300 ft., 23. iv. 1929 (*H. M. Pendlebury*).

Typus ♂ in meiner Sammlung ; Allotypus ♀ von N.-O. Borneo, früher vom Museum Dresden erhalten, wo sich wahrscheinlich noch weitere Stücke befinden.

Wurde von mir früher fälschlich als zu *O. staudingeri* Rég. gehörig angesehen, ist aber unterscheidbar durch die mehr längliche und weniger gewölbte Gestalt, die stärker geschweifte Innenkante der Tomentbinde des Halsschilds und die apikal schwächer verjüngten, mehr ovalen Vordertarsen des ♂ *. Verschieden sind ferner die männlichen Genitalien. Bei *O. planatus* ist der Oedeagus schmäler und etwas kürzer als die Parameren,

* Anscheinend besteht ein Irrtum, wenn Régimbart (1907, Ann. Soc. Ent. Fr. lxxvi. p. 198) angibt, dass die Vorderbeine des ♂ bei *O. staudingeri* merklich robuster seien als bei *O. matruelis*. Wohl sind die Tibien bei ersterem länger, aber nicht breiter, und die Vordertarsen weniger oval und apikal stark verjüngt, also eher zierlicher zu nennen.

subparallel, in der Mitte leicht eingeschnürt, in einer stumpfen Spitze endigend; von der Seite gesehen letztere leicht S-förmig gebogen. Bei *O. staudingeri* ist der Oedeagus plumper, kürzer, pfriemenförmig, von der Basis zur Spitze verjüngt, mit kaum merklicher Aufbiegung der letzteren.

Grosse Aehnlichkeit besteht mit *O. subsinuatus* Ochs, doch ist die neue Art eher noch etwas schlanker und flacher, der glatte Raum auf den Flügeldecken durchschnittlich länger und stärker zugespitzt, obgleich hier mit einem gewissen Grad von individueller Variabilität gerechnet werden muss. Beim ♂ ist der apikale Aussenwinkel der Vorderschienen nicht nach aussen vorgezogen, die Vordertarsen sind mehr oblong und apikal schwächer verjüngt, der Oedeagus seitlich gesehen weniger stark aufgebogen, sonst ähnlich.

Orectochilus subsinuatus Ochs.

Orectochilus subsinuatus Ochs, 1928, Ent. Bl. xxiv. p. 99.

Foot of Mt. Dulit, junction of rivers Tinjar and Lejok, 22. viii. 1932, Lejok stream, below surface, alt. 850 ft., primitive forest (*Hobby & Moore*), 1 ♂.

Mt. Dulit, 4000 ft., 25. x. 1932, under overhanging rocks (*Hobby, Moore, & Ford*), 1 ♂, 1 ♀.

Mt. Dulit, river Lejok, fairly still water, 15. x. 1932, moss forest (*Hobby, Moore, & Ford*), series.

Mit diesem Material wurde zum ersten Mal das ♀ dieser Art erbeutet. Dieses ist durchschnittlich etwas kleiner und länglicher als das ♂, der glatte Raum auf den Flügeldecken reicht bei ihm etwas weiter nach hinten und ist oval mit kurzer Spitze. Der Oedeagus des ♂ ist kürzer als die Parameren, von oben gesehen pfriemenförmig, wenig verjüngt, etwas breiter als eine Paramere, von der Seite gesehen stark S-förmig gekrümmt mit aufgebogener stumpfer Spitze.

Da kräftig entwickelte Männchen des *O. staudingeri* eine ähnliche Bildung der Vorderschienen aufzuweisen haben wie bei *O. subsinuatus*, seien als Unterscheidungsmerkmale für letzteren erwähnt: länglichere, schwächer gewölbte Körperform; stärker S-förmig geschweifte Innenkante der Tomentbinde des Halsschilds (ausnahmsweise gerade bei *staudingeri*); Oedeagus parallelseitiger und in der Seitenansicht stärker gekrümmt

Orectochilus biformis, sp. n.

Long. ♂ 8 mm., ♀ 6–7 mm. Ovatus, sat elongatus, postice attenuatus, convexus. Supra niger, nitidus, in capite et pronoto leviter æneseens, ad latera late tomentosus, pubescentia lutea, ferrugineo-limbatus ; infra piceus, abdomine pedibusque rufescentibus, epipleuris ferrugineis. Labro transverso, postice punctato-piloso, antice subtiliter reticulato, leviter arcuato et flavo-ciliato. Capite fortiter reticulato, areolis rotundatis, in clypeo magis transversis. Reticulatione in pronoto minus impressa, areolis elongatis transversis, in spatio lævi elytrorum subtilioribus elongatissimis obliquis. Margine tomentoso in pronoto latissimo, spatio lævi regulariter trapezoidali, in elytris spatio lævi scutellari in ♂ angusto, antice subparallelo, postice acuminato, in ♀ multo latiore subcordiformi. Truncatura elytrorum obliqua, angulo suturali leviter rotundato, in ♂ extus sinuata, angulo externo distincto subprominulo, in ♀ convexa, nec sinuata, angulo externo fere deleto. Tibiis anticis rectis, apicem versus intus dilatatis, ad basin attenuatis, antice recte truncatis, angulo externo apicali rotundato ; tarso parum dilatato, regulariter a basi ad apicem attenuato, lateribus rectis. In ♀ tibiis anticis minus dilatatis ; tarso angusto subparallelo.

Habitat.—Borneo, Sarawak, foot of Mt. Dulit, junction of rivers Tinjar and Lejok, 22. viii. 1932, Lejok stream below surface, alt. 850 ft., primitive forest (*Hobby & Moore*).

Typus ♂ im British Museum. Allotype ♀ und 3 Paratypen ♀ ebendaselbst und in meiner Sammlung.

Der folgenden Art ähnlich, aber kleiner und im weiblichen Geschlecht von ihr und den anderen Verwandten leicht zu unterscheiden durch die aussen nicht geschweifte Trunkatur und den fast verrundeten apikalen Aussenwinkel der Flügeldecken. Die unbehaarte Skutellarpartie ist beim ♂ schmäler als bei *O. kinabaluensis* Ochs (weniger als die Hälfte der Entferung von der Flügeldeckennaht bis zur Mündung der Haarbinde des Halsschilds an dessen Basis einnehmend), beim ♀ ebenfalls von geringerer Ausdehnung, wenn auch ähnlich geformt wie bei der verglichenen Art. Der Oedeagus des ♂ ist von oben gesehen sehr schlank, Oberseite mit Ausnahme der Basis und der Spitze längskielig mit Längsrinne etwa in der Mitte der Länge und von etwa 1/4 der Gesamtlänge des Glieds. In Höhe der Längsrinne beiderseits mit

breitem Hautsaum und hörnchenartigen Vorragungen, basalwärts leicht eingeschnürt, bis zum Beginn der eigentlichen Spitze ziemlich parallel, letztere von der Seite gesehen stark aufgebogen, woran man die Art leicht erkennt.

[*Orectochilus kinabaluensis*, sp. n.]

Orectochilus pubescens Rég., 1907, Ann. Soc. Ent. Fr. lxxvi. p. 201 (Kinabalu).
Orectochilus pubescens Ochs, 1928, Ent. Bl. xxiv. p. 99 (Kinabalu).
Orectochilus pubescens Ochs, 1932, Ent. Bl. xxviii. p. 174 (Kinabalu).

Der echte *O. pubescens* Rég. stammt von Sarawak (S.W. Borneo) und wird als nächste Art besprochen. Die Stücke von Kinabalu (N.-O. Borneo) sind artlich verschieden, Die von Régimbart (*l. c.* 1907) gegebene Diagnose vermischt die Charaktere des echten *O. pubescens* mit denen der neuen Art vom Kinabalu ; für letztere gelten folgende Angaben :

Long. ♂ 8–9, ♀ 7–7½ mm. Ovatus, sat elongatus, postice attenuatus, valde convexus. Supra piceo-niger, nitidus, in regionibus glabris leviter ænescens, ad latera late tomentosus, pubescentia lutea, ferrugineo-limbatus ; infra piceus, abdomine pedibusque rufescentibus, epipleuris ferrugineis. Labro transverso, postice punctato-piloso, antice subtiliter reticulato, leviter arcuato et flavo-ciliato. Clypeo postice sat fortiter reticulato (areolis fere rotundatis), remote punctato, antice fere lævi, leviter emarginato. Reticulatione in capite et pronoto sat fortiter impressa, areolis rotundatis, in disco pronoti magis transversis, minus impressis, in spatio lævi elytrorum subtilioribus, elongatissimis, obliquis. Margine tomentoso in pronoto latissimo, spatio lævi regulariter trapeziformi, in elytris spatio scutellari lævi in ♂ parum lato, antice subparallelo, postice acuminato, in ♀ multo latiori, subcordiformi. Truncatura elytrorum leviter obliqua, extus leviter sinuata, angulo externo distincto, subprominulo. Tibiis anticis rectis, apicem versus intus dilatatis, ad basin attenuatis, antice recte truncatis, angulo apicali externo rotundato ; tarso parum dilatato, regulariter a basi ad apicem attenuato, lateribus fere rectis. In ♀ tibiis anticis minus dilatatis, tarso angusto subparallelo.

Habitat.—Britisch Nord-Borneo, Kinabalu, 1500 m. (*Waterstradt*).

Typus ♂ und Allotypus ♀ im Zoologischen Museum der Universität Berlin, Paratypen ebendaselbst und in

meiner Sammlung, das von Régimbart (*l. c.* 1907) erwähnte Material von Oberthür und Staudinger stammt anscheinend aus der gleichen Quelle.

Zu *O. kinabaluensis* gehören ferner die früher von mir als *pubescens* erwähnten Stücke von N.-O. Borneo (Museum Dresden); Kinabalu, 2500 ft., 22. viii. 1913 (Sarawak Museum); Kinabalu, 3500 ft., 8. iv. 1929, 4000 ft., 18. iv. 1929 (*Pendlebury*, F.M.S. Museum); Kenokok river, 3300 ft., 23. iv. 1929 (*id.*); Koung to Kabayan, 1000 ft., in stream, 6. v. 1929 (*id.*).

Dies ist die grösste Art der Gruppe, von länglicher Gestalt und starker Wölbung, besonders das ♂ hinter dem Schildchen fast etwas bucklig. Oberseite ohne Rotfärbung, auch das Analtergit dunkel, höchstens die Spitze rötlich. Die glatten Partien von Kopf, Halsschild und Flügeldecken mit Erzschein. Die glatte Skutellarpartie des ♂ ist breiter als bei voriger Art (mehr als die Hälfte der Entfernung von der Flügeldeckennaht bis zur Mündung der Haarbinde des Halsschilds an dessen Basis einnehmend), vorn subparallel, hinten spitz verlaufend, weniger als die Hälfte der Flügeldeckenlänge einnehmend; beim ♀ ausgesprochen herzförmig, etwa von halber Flügeldeckenlänge, in der grössten Breite breiter als die glatte Mittelpartie des Halsschilds.

Der Oedeagus ist von oben gesehen breiter, von der Basis zum Apex allmählich verjüngt, mit geringfügiger Einschnürung kurz vor der Spitze. Die Oberseite hat, mehr nach der Basis zu gelegen, eine Längsrinne von etwa halber Länge des Glieds, welche sich bis zum Beginn der Spitze nach vorn kielig fortsetzt. Längs der Unterkante verläuft beiderseits, von oben fast auf die ganze Länge sichtbar, ein breiter Hautsaum, über diesem etwas vor der Mitte beiderseits eine hörnchenartige Vorragung. Seitlich gesehen ist der Oedeagus an dieser Stelle etwa am breitesten, weiter vorn nochmals leicht eingeschnürt, die rundliche Spitze nur leicht aufwärts gebogen.

[*Orectochilus pubescens* Rég.]

Orectochilus pubescens Rég., 1882, Ann. Mus. Stor. Nat. Genova, xviii. p. 73.

Orectochilus pubescens Rég., 1883, Ann. Soc. Ent. Fr. (6) iii. p. 419, T. xii. f. 127, 127 *a*.

" *Gyrinidæ* " Bryant, 1919, Ent. Mon. Mag. lv. p. 76.

Orectochilus ferruginicollis Ochs, 1924, Ent. Bl. xx. p. 238.

Orectochilus ferruginicollis Ochs, 1928, Ent. Bl. xxiv. p. 100 (ex p.).
Orectochilus pubescens Ochs, 1928, Ent. Bl. xxiv. p. 99 (ex p.).

Régimbart beschrieb (*l. c.* 1882, 1883) seinen *O. pubescens* nach einem einzelnen ♂ von Sarawak aus der Ausbeute des Marchese J. Doria und Dr. O. Beccari. Liest man diese Beschreibung aufmerksam, so stösst man auf Merkmale, die für Stücke vom Kinabalu, die Régimbart später zu *pubescens* stellte, nicht zutreffen, namentlich die Rotfärbungen an Oberlippe, Vorderkopf und der Oberseite des Analtergits. Dies veranlasste mich, die mir vorliegenden Serien einer nochmaligen gründlichen Prüfung zu unterziehen, zumal *O. biformis* aus dem Dulit-Gebiet als weitere neue Art dieser schwierigen Gruppe hinzukam, wobei sich herausstellte, dass die Stücke aus Süd-Sarawak mit der Urbeschreibung des *O. pubescens* Rég. übereinstimmen, während die bisher fälschlich zu *pubescens* gerechneten Exemplare vom Kinabalu eine andere Art repräsentieren, die vorstehend von mir als *O. kinabaluensis* beschrieben wurde.

Der echte *O. pubescens* liegt mir vor von Sarawak, Mt. Merinjak, 600 ft., 23. v. 1914 (*G. E. Bryant*) und Matang, 3600 ft., vi. 1900, 3200 ft., 1. viii. 1909; letztere etwas dunkler gefärbt als erstere. Diese Art ist durchschnittlich etwas kleiner als *O. kinabaluensis*, etwas grösser als *O. ferruginicollis* Rég., dem sie gleichzeitig infolge der kürzeren Gestalt und der Zunahme der roten Färbungselemente am nächsten steht. Vorderrand von Oberlippe und Clypeus sind bei *O. pubescens* rot, desgleichen die Oberseite des Analtergits, und die glatten Partien von Halsschild und Flügeldecken sowie der hintere Teil der letzteren rötlich durchscheinend. Die Wölbung ist flacher als bei *O. kinabaluensis*, etwa wie bei *O. ferruginicollis*, und wie bei letzterem das ♀ merklich flacher als das ♂. Beim ♂ ist die glatte Skutellarpartie schmäler als bei *O. kinabaluensis* und *ferruginicollis*, ähnlich wie bei *O. biformis*, von länglich dreieckiger Form, oft im vorderen Teil etwas parallelseitig, zur Spitze manchmal etwas eingeschnürt, etwa 1/3 der Flügeldeckenlänge erreichend. Beim ♀ ist diese Partie breiter als beim ♂ und etwas länger, von leicht herzförmiger Form, schmäler als der glatte Raum des Halsschilds, in der Ausdehnung ähnlich wie bei *O. ferruginicollis*, viel kleiner als bei *O. kinabaluensis*.

Der Oedeagus des ♂ ähnelt dem des *O. kinabaluensis*, aber ohne den breiten Hautsaum und daher in der Aufsicht schmäler erscheinend. Die Längsrinne der Oberseite liegt mehr nach der Spitze zu, nach vorn weniger kielig, davor und dahinter eine leichte Einschnürung, die hörnchenartigen Vorragungen etwa unter der Mitte der Längsrinne. Seitenansicht ähnlich wie bei *O. kinabaluensis*, Spitze kaum aufgebogen und schärfer.

Bei *O. ferruginicollis* Rég. ist der Oedeagus von oben gesehen viel schlanker als bei den verwandten Arten. Der Basalteil verjüngt sich rapid nach vorn, die restlichen etwa 3/4 der Länge sehr schmal und subparallel, schmaler als eine Paramere. Hautsaum der Unterkante nur schmal, die hörnchenartigen Vorragungen hinter der Mitte. Die Längsrinne der Oberseite ebenfalls hinter der Mitte, der davor liegende Teil scharf kielig bis kurz vor das Ende. Letzteres leicht verbreitert, geschlitzt, zwischen den zangenartig vorragenden Seitenteilen ragt in der Mitte ein quer abgestutztes Mittelstück vor, ähnlich wie ein Penis zwischen den Parameren, also eine sehr merkwürdige Bildung. Seitlich gesehen ist der Oedeagus ebenfalls sehr schmal, die grösste Breite liegt hinter der Mitte, nach vorn allmählich verjüngt, die Spitze leicht aufwärts gerichtet.

[*Orectochilus pendleburyi* Ochs.]

Orectochilus cupreolus Ochs, 1928, Ent. Bl. xxiv. p. 101.
Orectochilus cupreolus Ochs, 1930, Ent. Bl. xxvi. p. 17.
Orectochilus pendleburyi Ochs, 1932, Ent. Bl. xxviii. p. 174.
Orectochilus brevitarsis Falkenström, 1934, Zool. Anz. cvii. p. 208.

Zweifellos ist *O. brevitarsis* Falk. mit meinem *O. pendleburyi* identisch, und es ist bedauerlich, dass Falkenström vor Abfassung seiner Arbeit nicht genügend die Literatur zu Rat gezogen hat. Mein Aufsatz von 1932 hätte ihm alsdann nicht verborgen bleiben können, und der Nomenklatur wären die Synonyme des *O. brevitarsis* und *O. coracinus* erspart geblieben. Ausserdem wäre die unfreundliche Polemik überflüssig gewesen, die Falkenström an meine ursprüngliche Falschinterpretation des *O. cupreolus* Rég. knüpft, weil die Angelegenheit inzwischen bereits durch mich eine Berichtigung erfahren hatte. Im übrigen sollte Herr Falkenström wissen, dass dimorphe Weibchen bei den Gyriniden keine Seltenheit sind, zahlreiche Arten

der Gattungen *Gyretes* und *Orectogyrus* haben zwei und mehr Weibchenformen.

[*Orectochilus corniger* Zaitz.]

Orectochilus corniger Zaitz., 1910, Rev. Russe Ent. x. p. 224.
Orectochilus corniger Zimm., 1917, Ent. Mitt. vi. p. 168.
Orectochilus corniger Peschet, 1923, Opusc. Inst. Sc. Saigon, i. pp. 11 u. 12.
Orectochilus corniger Ochs, 1927, Suppl. Ent. xv. pp. 117 u. 122.
Orectochilus corniger Ochs, 1928, Ent. Bl. xxiv. p. 101.
Orectochilus corniger Ochs, 1930, Ann. Mus. Zool. Acad. St. Petersb. xxxi. p. 69.
Orectochilus corniger Ochs, 1931, Arch. Hydrobiol., Suppl. 8, Trop. Binnengewässer, i. p. 474.

Dass Zoologische Museum Berlin besitzt 1 Exemplar aus der Ausbeute Waterstradt's von Nord-Borneo, Kinabalu.

(?) *Orectochilus pusillus* Rég.

Orectochilus pusillus Rég., 1882, Ann. Mus. Stor. Nat. Genova, xviii. p. 74.
Orectochilus pusillus Rég., 1883, Ann. Soc. Ent. Fr. (6) iii. p. 430.
(?) *Orectochilus pusillus* Ochs, 1928, Ent. Bl. xxiv. p. 102.

Mt. Dulit, river Koyan, 2500 ft., 17. xi. 1932, primary forest (*Hobby & Moore*).

In der Ausbeute der Oxford University Expedition befindet sich ein einzelnes Weibchen, welches vielleicht zu *O. pusillus* Rég. gehört, vom dem bisher nur das Männchen bekannt war. Es entspricht der Urbeschreibung in Grösse, Form und Färbung der Oberseite, die Unterseite ist aber dunkler und die tomentierte Seitenbinde der Flügeldecken hinten stärker verbreitert als für das Männchen angegeben. Bei dem mir vorliegenden Tier ist der Clypeus in der Mitte ausgerandet, er und der Kopf bis auf den Scheitel ziemlich grob quermaschig retikuliert, Halsschild feiner retikuliert. Flügeldecken quermaschig schräg sehr fein retikuliert, hinten deutlicher, stark irisierend, ausserdem mit undeutlichen Querstricheln. Tomentbinde auf dem Halsschild vorn bis ans halbe Auge reichend, hinten parallel, auf den Flügeldecken vorn ebenso breit, hinter der Basis sofort verschmälert, dann allmählich in wenig konkaver Linie verbreitert. Vordertibien mit wenig verrundetem apikalem Aussenwinkel.

Orectochilus seminitens, sp. n.

Long. 5 mm. Ovatus, parum elongatus, antice attenuatus, convexus. Supra niger, leviter æneseens, ad latera punctato-tomentosus, luteo-marginatus. Infra piceus, pectore medio,

abdomine pedibusque rufescentibus, epipleuris flavis. Labro ferrugineo, fere semicirculari, supra rotundatim reticulato et remote punctato, postice ad latera punctato-piloso, antice flavo-ciliato. Capite fortiter reticulato, areolis elongatis, transversis, reticulatione in pronoto et elytris minus impressa, valde transversa et obliqua; in elytris postice ad latera plaga magna longitudinali fortiter reticulata, areolis rotundatis bene impressis. Margine tomentoso in pronoto parum lato, post oculos valde, postice minime dilatato, in elytris antice minus lato, ad basin breviter intus dilatato, postea leviter undulatim regulariter dilatato et suturam angustissime secundum truncaturum attingente. In spatio glabro striis plurimis vix visibiliter præbentibus. Truncatura fortiter convexa, angulo interno obtuso deleto, extus sinuata, angulo externo acuto prominulo. Tibiis anticis in ♂ parum dilatatis, antice fere recte truncatis, angulo apicali externo rotundato, tarsis elongato-ovatis, antice parum attenuatis; in ♀ tibiis angustioribus, tarsis subparallelis.

Habitat.—Borneo, Sarawak, Mt. Dulit, river Koyan, 2500 ft., 17. xi. 1932, primary forest (*Hobby & Moore*).

Typus ♂ und Allotypus ♀ im British Museum; Paratype ♀ in meiner Sammlung.

Gehört in die Gruppe VI meiner Arbeit von 1928 (Ent. Bl. xxiv. pp. 78 u. 101) und schliesst sich eng an an *O. pusillus* und *O. caliginosus* Rég., nächster Verwandter vermutlich *O. mjöbergianus* Falk. (1934, Zool. Anz. cvii. p. 210). Grösser als die an erster Stelle genannten beiden Arten, in Gestalt dem *O. pusillus* (vorausgesetzt, dass das am gleichen Fundort erbeutete Stück zu dieser Art gehört) gleich, aber ohne weiteres verschieden durch die grob rundmaschig retikulierten Längsflecken auf den Flügeldecken in beiden Geschlechtern. *O. caliginosus* ist nach der Beschreibung von Régimbart von länglicherer Gestalt, und das bisher allein bekannte ♀ hat die ganze Oberseite grob rundzellig retikuliert.

Nach der Beschreibung in Gestalt und Grösse dem *O. mjöbergianus* Falk. anscheinend sehr ähnlich, Färbung der Oberseite dunkler, schwarz mit Erzschein, Analtergit ganz schwarz. Auf den Flügeldecken befindet sich bei der neuen Art in beiden Geschlechtern eine grosse matte Stelle, verursacht durch eine grobe rundzellige Retikulierung, und zwar in Form eines Längswischs, welcher die Tomentbinde innen etwas breiter als diese etwa vom ersten Drittel bis an die Trunkatur begleitet. Die

Ausdehnung des matten Flecks ist etwas variabel, auf dem glatten Raum der Flügeldecken sind einige Längsstreifen angedeutet. Die Tomentbinde scheint auf den Flügeldecken hinten weniger kräftig abgesetzt als bei *O. mjöbergianus*, die S-förmige Schweifung ist nur leicht angedeutet und zwar im letzten Drittel. Die Trunkatur ist stark convex, vor dem Aussenwinkel ausgeschweift, dieser kurz spitz vorgezogen.

Der Oedeagus des ♂ ist bei der neuen Art ebenfalls sehr kompliziert und vermutlich ähnlich wie bei *O. mjöbergianus* gebaut, jedoch erscheint mir der von Falkenström als Penisanhang gedeutete Teil fest mit dem Oedeagus verbunden und lediglich als dessen, allerdings stark spezialisierte Endigung. Von oben gesehen besteht der Oedeagus aus einem ziemlich parallelseitigen Schaft, der im letzten Drittel eine länglichovale Vertiefung hat. Diese wird an den Längsseiten begrenzt durch je einen, einer regulären Paramere nicht unähnlichen, apikal zugespitzten Längswulst, den apikalen Abschluss bildet eine erhöhter, kantiger, beiderseits leicht überstehender Querwulst, darunter ragt der kugelig zugespitzte Apex noch ein wenig hervor. Von der entgegengesetzten Seite sieht der Oedeagus etwa so aus wie die Abbildung 1 bei Falkenström, jedoch ist der vorderste Teil etwas mehr zugespitzt und ist eingebettet in eine Mulde, auf deren Rückseite die vorher erwähnten Wülste liegen und seitlich vorragen, welche Bildung vielleicht als Anhang gedeutet werden könnte. Von der Seite gesehen bietet sich folgendes Bild. Der basale Schaft verjüngt sich leicht bis zu der Stelle, an der die zuerst erwähnte Vertiefung auf der Oberseite beginnt. Die letztere begrenzenden Längswülste sind an ihrer Basis nach unten abgebogen und verfolgen alsdann die bisherige allgemeine Richtung, ihr scharfes Ende erscheint von der Seite als senkrechte Kante. Auf der Unterseite befindet sich an der korrespondierenden Stelle eine Anschwellung. Davor ragt nach oben der Querwulst, von andeutungsweise ambosartigem Querschnitt, von der Vorderkante der Längswülste durch eine halbrunden Ausschnitt getrennt. Unter dem Querwulst entspringt die nach vorn und oben gerichtete rundliche Spitze. Der Penis ist nur etwa 2/3 so lang wie die Parameren, letztere sind im Querschnitt stark gebogen, das umgebogene Stück in etwa 2/3 Länge endigend, an dieser Stelle eine Querreihe von Borstenhaaren.

these disturbed days science should have a message of goodwill to the world; and to such a message, fortified at each of our sessions by practical demonstration, we have put our hand at this sectional gathering, now meeting for the third time in the great industrial city of Nottingham.

A generation ago it was fashionable to draw a working distinction between the applied and pure physicist, it being considered that when given a piece of research to carry out, the former consciously or unconsciously applied Benjamin Franklin's stock question 'What is the use of it?' Nowadays it is appreciated that any such distinction can only be largely artificial, for there have been many outstanding illustrations during the last half century of how speedily and inevitably results of no preconceived practical value may glide into widespread industrial utilities. For example, when only forty years ago Sir. J. J. Thomson discovered the electron, no one could ever have imagined that, as Dr. K. T. Compton recently informed us, an industrial business amounting to some hundreds of millions of pounds a year would now owe its existence to electronic devices. Already, both neutrons and radio-sodium are being experimented with in radiation therapy; and furthermore, some of the artificial radioactive elements have found an important field of use in biological processes, both in animals and plants, providing, as they do, by their characteristic radioactive decay, a method of identifying migrating atoms a million times more sensitive than any that analytical chemistry can offer. Again, to judge by the 1936 report of the Comptroller-General of the Patent Office, technical applications are also being sought for the transmutation of elements by bombardment with short-wave radiation or high-speed particles.

Thus even the most practically minded among us need find no difficulty in appreciating the profound fascination and basic significance of some of the present-day developments of modern physics, and recognising the driving genius behind them. But applied physics has its victories no less than pure physics; and speaking as one who has spent some thirty happy years in both the pure and applied schools of physical research, I can testify that dealing with materials which are neither intangible nor ephemeral, does not necessarily cramp outlook or stifle enthusiasm; and applied workers are no less able to share the stimulus of conquering a stubborn investigation, and with it all, enjoy the satisfaction of seeing many of their labours turned to early account in the interests of the community. Perhaps some day they will also take to heart some of the social implications of their work.

There must be many of us, both workers and onlookers, who at times feel a little overwhelmed by the way the ramifications of physical research year by year continue to extend. Not uncommonly, the methods of attack are so involved and the technique so formidable, that despite the great all-round improvements in equipment, the calls on the pertinacity and patience of the worker are no less than in the past. Incidentally, while present-day equipment is often much more elaborate and efficient, it is also apt to be much more costly than that of a generation ago, as those who direct physical laboratories are well aware. This applies alike to the pure and the applied physics laboratory; and although their

Orectochilus laticinctus Rég.

Orectochilus laticinctus Rég., 1907, Ann. Soc. Ent. Fr. lxxvi. p. 220.
Orectochilus laticinctus Ochs, 1928, Ent. Bl. xxiv. p. 102.

Mt. Dulit, river Koyan, 2500 ft., 17. xi. 1932, primary forest (*Hobby & Moore*).

Ein einzelnes Weibchen, welches sich mit Paratypen in meiner Sammlung in allen Charakteren deckt.

EXPLANATION OF PLATE XVIII.

Œdeagus von *Orectochilus seminitens*, sp. n.
Seitenansicht, etwas verdreht.

Oedeagus von Orectochilus seminitens, sp. n.

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
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***Results of the Oxford University Expedition to Borneo*, 1932. Dryopidæ (*Coleoptera*).—Part I.** By H. E. HINTON (Zoological Laboratory, Cambridge).

THE Dryopidæ collected by the Oxford University Expedition to Borneo * were sent to me through the kindness of Sir Guy Marshall. The collection has now been worked up, and the results are incorporated in the following paper.

The importance of the collection of Dryopidæ here dealt with is amply indicated by the fact that until now eight species belonging to two genera were recorded from Borneo, whereas now these numbers have been increased to five genera and twenty-three species, of which fourteen species are here described for the first time. In addition, there are four species represented by single female specimens, which I have not been able to assign to any of the known species, and which, because of their sex, I hesitate to describe as new.

A summary of the sixty-one specimens in the collection is as follows :—

	DRYOPINÆ.	
1.	*Helichus elongatus* Reitt.	12
2.	*Sostea cyanoptera* Pasc.	2
3.	—— *hirtifera* Waterh.	1
4.	—— *elmoides* Pasc.	16
5.	—— *crassa*, sp. n.	1
6.	—— *punctiventris*, sp. n.	2
7.	—— *cyanea*, sp. n.	6
8.	—— *thoracica*, sp. n.	1
9.	—— *fusca*, sp. n.	5
10.	—— *insolita*, sp. n.	2
11.	—— *parva*, sp. n.	1
12.	—— *scottianus*, sp. n.	1
13.	—— *vicina*, sp. n.	1
14.	—— *hobbyi*, sp. n.	1
15.	—— *confusus*, sp. n.	1
	—— sp. ?	1
	—— sp. ?	1
	—— sp. ?	1
	—— sp. ?	1
	LARINÆ.	
16.	*Potamophilinus gravastellus*, sp. n.	1
	ELMINÆ.	
17.	*Stenelmis semifumosus*, sp. n.	2
18.	*Cyllœpus marshalli*, sp. n.	1

* For a general account of this expedition, see T. H. Harrison, 'Geographical Journal,' lii. pp. 385–410 (1933).

My best thanks are due to Dr. A. D. Imms for many helpful suggestions, to Dr. H. Scott for comparing several species of *Sostea* with the types, and to Dr. B. M. Hobby for various notes regarding the collection.

The types of the new species described below are in the collection of the British Museum (Natural History).

Since all the specimens were collected at Sarawak, Borneo, and since in nearly all instances they were collected by B. M. Hobby and A. W. Moore, these data will not be repeated for each specimen.

1. *Helichus elongatus* Reitt. (1881).

7, foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 28 August, 1932, 2, native collected, 1, light trap, 4, flood refuse and cut reeds; 3, same locality, but collected 1 October, 1932, at sheet light; 1, also same locality, but collected 29 August, 1932, in recent clearing, secondary forest; 1, River Kapah, tributary of River Tinjar, 22 September, 1932, in primitive forest.

This species had heretofore been recorded only from Sumatra.

2. *Sostea cyanoptera* Pasc. (1860).

2, foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 11 August, 1932, in old secondary forest beating undergrowth.

3. *Sostea hirtifera* Waterh. (1876).

1, River Kapah, tributary of river Tinjar, 2 October, 1932, on bark of felled tree in clearing for padi.

4. *Sostea elmoides* Pasc. (1860).

12, River Kapah, tributary of River Tinjar, 3 October, 1932, beating in primitive forest; 1, same data, but collected 4 October; 1, same data, but collected 2 October; 2, same data, but collected 1 October.

5. *Sostea crassa*, sp. n.

Female.—Length 3·5 mm.; breadth 1·67 mm. Subparallel, moderately strongly convex. Dorsal surface clothed with (unique before me is badly rubbed) fine,

moderately short (about ·05 mm.), recumbent, moderately dense, testaceous hairs and also clothed with stouter, much longer, sparser, erect, nearly black hairs which on head are occasionally ·37 mm. long, but here and on pronotum and on elytra are usually about ·25 mm. long—these long hairs are usually broadened at apex, and when seen under oil-immersion appear to have about six short acute processes on apex; there is very little intergradation between the short and long hairs. Ventral surface clothed as dorsal surface, but with the short hairs not so short, and the longer hairs usually less stout and less often broadened at apex. Cuticle feebly shining, dark rufo-piceous; apical segments of antennæ, mouth-parts, legs, and ventral surface paler rufo-piceous. *Head* with a broad, but very feeble, impression on vertex, without other distinct impressions. Surface punctate with usually nearly round shallow punctures, which are often as much as ·12 mm. in diameter (more than three times as coarse as facets of eyes) and are often confluent, and are seldom separated by more than a fourth their diameters; surface of clypeus with a few indistinct finer punctures, and with numerous indistinct microscopical punctures. *Prothorax* at broadest point, which is at basal third, more than a third broader than long (1·50 mm. : ·90 mm.) and base broader than apex (1·40 mm. : 1·00 mm.). Apical margin as seen from above evenly and moderately deeply arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, and slightly deflexed; sides moderately strongly arcuate, moderately converging towards apex, lateral margin irregularly crenate, with seven obtuse crenations which vary greatly in size; basal angles nearly rectangular, not prominent; base broadly and moderately deeply sinuate on each side, moderately narrowly rounded in front of scutellum. Pronotum strongly convex, with a broad, but feeble, median longitudinal impression on anterior two-fifths, with a feeble and very broad longitudinal impression near each side on basal third; surface punctate as head, but with the punctures near base slightly finer (often as fine as ·05 mm.) and sparser. *Elytra* nearly three times as long as prothorax (2·62 mm. : ·90 mm.), and from broadest point across humeri (1·62 mm.) feebly broadened to greatest breadth at apical third (1·67 mm.). Humeri

moderately strongly gibbous. Each elytron with a very large, round, feebly gibbous area occupying basal fifth of each elytron; elsewhere without distinct gibbosities. Lateral margins not crenate. Surface striate, striæ scarcely noticeable on disk, but becoming more evident towards sides; strial punctures as follows: punctures of first stria round to subquadrate, separated longitudinally usually by about or slightly more than their diameters, at base about a third as broad as sutural interval, but becoming narrower towards apex, though on apical third again broader; strial punctures become coarser and denser towards sides, so that at fourth stria the strial punctures are as broad as fourth interval. Intervals nearly flat; surface with the only distinct punctures being those which give rise to the long setæ. Scutellum flat, triangular, with the sides and base rounded, as long as broad (·12 mm. : ·12 mm.), and surface with a few fine indistinct punctures. *Prosternal process* with a carinate elevation not extending to base; sides opposite coxæ strongly raised; prosternum at middle as coarsely, but more sparsely punctate than base of pronotum; on lobe slightly more finely, but more deeply and sparsely punctate, and also with a few very fine and indistinct punctures; hypopleura with the punctures as coarse as those near base of pronotum, but deeper and sparser. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process moderately strongly gibbous. Disk of metasternum feebly concave on each side; with a fine median longitudinal line which attains neither the base nor the apex and at posterior third is suddenly broadened, and deepened for a short distance; surface throughout with numerous fine punctures, and near sides sparsely punctate with punctures which are about as coarse as those of pronotum; sides very strongly, coarsely, and densely alutaceous, punctate as sides of disk, but with the punctures seldom separated by more than twice their diameters. Base and sides of basal abdominal segment punctate as sides of metasternum; sides of other segments similarly, but more finely and sparsely punctate; sides of all segments alutaceous, as sides of metasternum. Legs without coarser punctures, but densely microscopically punctate.

Male.—Unknown.

Type.—Female. River Kapah, tributary of River Tinjar, 2 October, 1932, on bark of felled timber.

Comparative Notes.—This species is close to no other species known to me.

6. *Sostea punctiventris*, sp. n.

Male.—Length 3 mm.; breadth 1·5 mm. Obovate, strongly convex. Dorsal surface clothed with fine, moderately short (about ·06 mm.), recumbent to nearly erect, testaceous hairs which are rather dense on head, prothorax, and scutellum, and slightly longer and sparser on elytra, the hairs being separated at their bases by about a third of their lengths or more; also clothed with similar, but much longer, sparser, erect hairs which on head and prothorax are often ·37 mm. long and on elytra are usually not over ·25 mm.; on head and prothorax the two types of pubescence are usually quite distinct, but on elytra there is much intergradation. Ventral surface clothed for the most part similarly to prothorax, but with the short hairs not so short, and the long hairs much less numerous and seldom as long as longer ones of elytra. Cuticle shining, rufo-piceous; pronotum and scutellum nearly black, elytra moderately dark, metallic blue; apical segments of antennæ, mouth-parts, and tarsi paler rufo-piceous. *Head* without distinct impressions. Surface microscopically punctate (punctures about ·002 mm. in diameter) with round punctures which are separated by two to four times their diameters; also punctate with round shallow punctures, which are distinctly coarser than facets of eyes (·035 mm. in diameter) and are separated generally by less than their diameters, but occasionally by as much as once their diameters; surface of clypeus only microscopically punctate, these punctures being similar to finer punctures of head. *Prothorax* with broadest point, which is near basal fourth, nearly twice as broad as long (1·27 mm.: ·725 mm.), and base broader than apex (1·25 mm.: ·825 mm.). Apical margin as seen from above evenly and moderately deeply arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, much deflexed; sides moderately arcuate, moderately converging towards apex, lateral margins not distinctly crenate; basal angles not prominent, nearly rectangular; base deeply and broadly sinuate on each side, moderately

rounded in front of scutellum. Pronotum with anterior four-fifths moderately strongly and somewhat transversely convex. Surface with two sizes of punctures, as follows: microscopical punctures similar in size and density to those of head; coarse punctures on middle of disk similar to coarse punctures of head, but towards base become denser and towards sides coarser, deeper, and denser. *Elytra* three times as long as prothorax (2·37 mm. : ·72 mm.) and from broadest point across humeri feebly broadened to greatest breadth at apical two-fifths (1·45 mm. : 1·55 mm.). Humeri feebly gibbous, elytra elsewhere without gibbosities of any sort. Lateral margins not crenate. Surface striate, striæ scarcely noticeably impressed on basal two-fifths of disk; strial punctures as follows: punctures of first stria nearly round and separated longitudinally by once their diameters, near base less than a third as broad as sutural interval, becoming finer beyond middle of disk, and again near apex as coarse as at base; striæ from second on with the punctures gradually becoming coarser and denser, so that quadrate punctures of fourth stria are broader than fourth interval. Intervals on disk flat; punctate, with punctures which are generally slightly coarser and sparser than microscopical punctures of pronotum. Scutellum as long as broad (·12 mm. : ·12 mm.), flat, triangular, with the sides and base rounded and surface with punctures similar to microscopical punctures of pronotum. *Prosternum* having on the process a short, convex, longitudinal line between coxæ; sides of process moderately raised; prosternum at middle punctate as pronotum, but with the coarse punctures finer and sparser; on lobe coarse punctures are even finer and sparser; hypopleura with the coarse punctures coarser and about as dense as those of front angles of pronotum. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process moderately gibbous. Disk of metasternum nearly flat; with a very fine, median, longitudinal line which attains neither base nor apex; surface more densely and finely punctate than elytral intervals, also with round punctures which are as coarse as coarsest of pronotum are more numerous posteriorly and are separated by less than to more than once their diameters; sides similarly, but more deeply, punc-

immediate objectives are usually very different, one finds, for example, in both the Cavendish and National Physical Laboratories, ample illustration of how large-scale and expensive apparatus has entered into both classes of physical investigation. Such apparatus is likely to be beyond the compass of the private research worker, who at one time cut a conspicuous figure in the scientific annals of this country, but who, with a few noteworthy exceptions, has now regrettably disappeared. Progress in industrial research, at any rate, seems to be more and more bound up with specialised team attack, whether to solve a specific problem or to develop a new invention or product.

There is one other matter to which I would like to refer. It has been claimed in some quarters that man's qualities of leadership are more likely to be developed by the older humanitarian studies than by the natural or mechanical sciences The dictum has doubtless the defects of all such generalisations, and more to the point, perhaps,. is the summing up of John Drinkwater, that 'the minds of men mostly belong to one or other of two kinds—the kind that wishes to dominate, and the kind that desires to understand.' Experience tempts one to hazard the view that the proportion of men who naturally seek leadership or administrative responsibility is small, possibly one in twenty or even less. Provided, however, the germs of initiative and common sense are there, the value of research in getting a man into the way of thinking for himself and developing a courageous and discriminating outlook is not to be questioned. It is to be hoped that the penetration into the major industries of scientifically trained young men, whose mental equipment is such as to fit them later on for responsible administrative jobs, is something which the Universities regard as of high national importance. In its turn, industry must play a part by recognising the advantages of admitting the pick of such men into the Board room more commonly than in the traditional past. Power without knowledge is a well-worn and discredited experiment in this country; and the conception that technical or scientific workers invariably require to be mothered by full-blooded non-scientific or quasi-scientific administrators is manifestly so much moonshine.

Before leaving the subject, I may perhaps comment on what I believe to be a weakness of a good many thoroughly capable men who come to an appointment fresh from a University and armed with an Honours science degree and perhaps a little research experience; that is, a difficulty in setting down their ideas and conclusions on paper concisely and logically and in reasonably good English, whether in letter or report. We must not, of course, expect to find old heads on young shoulders, but I feel sure that some sort of intensive course to cover these points ought to form a part of young people's University training; or perhaps we ought to insist on a more thorough grounding, particularly in English, before specialisation in science is allowed to begin. As it is, the drafting of a scientific paper by a beginner is liable to be an ordeal which is, I think, best tempered by the system of joint publication with a senior man, the experience being not only valuable educationally but often an eye-opener for both parties.

tate. Abdomen microscopically punctate as disk of metasternum; at middle and sides of basal segment and at sides of other segments with a few very shallow and indistinct punctures which are about as coarse as discal pronotal punctures. Legs only microscopically punctate. *Genitalia* with the median lobe evenly narrowed to, and sharply pointed at, apex, extending to within ·05 mm. of the apex of the parameres; parameres shorter than basal piece (·37 mm. : ·62 mm.), when viewed laterally parameres are moderately broad at apex with the outer face moderately convex.

Female.—Externally similar to male.

Type.—Male. River Kapah, tributary of River Tinjar, 2 October, 1932, on bark of felled tree.

Paratype.—Female with same data.

Comparative Notes.—This species resembles *S. cyanoptera* Pasc. very closely, but may be separated as follows: (1) *cyanoptera* has no punctures on the sloping sides of the metasternum between disk and pleuron, whereas in the new species there are numerous coarse punctures here; and (2) the length ratio of the parameres in *cyanoptera* is in the order of ·62 mm. : ·82 mm. instead of ·37 mm. : ·62 mm. as in the new species.

7. *Sostea cyanea*, sp. n.

Male.—Length 4 mm.; breadth 1·8 mm. Subparallel, moderately strongly convex. Dorsal surface clothed with fine, moderately short (about ·1 mm.), recumbent to nearly erect, testaceous hairs which are rather dense on head, prothorax, and scutellum and slightly longer and sparser on elytra, the bases of the hairs here being separated by a third of their lengths or more; also clothed with similar, but much longer and sparser, erect hairs which on head and prothorax are often ·5 mm. long, and on elytra are usually not over ·25 mm.; on head and prothorax the two types of pubescence are usually quite distinct, but on the elytra there is much intergradation. Ventral surface clothed for the most part similarly to prothorax, but with the short hairs not so short and the long hairs less numerous and seldom as long as longer ones of elytra. Cuticle strongly shining, rufo-piceous, with pronotum and scutellum nearly black, elytra moderately dark, metallic blue; apical segments of antennæ, mouth-parts, and tarsi

paler rufo-piceous. *Head* without distinct impressions. Surface microscopically punctate (punctures about ·002 mm. in diameter) with round punctures which are generally separated by two to four times their diameters; also punctate with round shallow punctures which are distinctly coarser than facets of eyes (·05–·07 mm.), and are generally separated by less than to three times their diameters; on basal portion of clypeus the coarse punctures are finer and sparser, on anterior portion of clypeus the surface is very finely and densely, transversely rugose. *Prothorax* at broadest point near basal third one-third broader than long (1·45 mm. : ·92 mm.), and base broader than apex (1·37 mm. : 1·02 mm.). Apical margin as seen from above evenly and moderately deeply, arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, slightly deflexed; sides moderately arcuate, moderately converging towards apex, lateral margins moderately irregularly, obtusely crenate; basal angles not prominent, rectangular; base deeply and broadly sinuate on each side, moderately rounded in front of scutellum, and here apparently extremely finely margined. Pronotum with anterior four-fifths rather strongly and transversely convex. Surface with two sizes of punctures as follows: microscopical punctures similar in size and density to those on head: and coarse punctures which on middle of disk are similar to those of head, but towards base become oblong-oval and slightly coarser and denser, at anterior angles they are round, but much coarser and denser than those of middle of disk. *Elytra* three times as long as prothorax (2·92 mm. : ·92 mm.) and from broadest point across humeri feebly broadened to greatest breadth at apical third (1·62 mm. : 1·80 mm.). Humeri feebly gibbous, elytra elsewhere without gibbosities of any sort. Lateral margins not crenate. Surface striate, striæ scarcely noticeably impressed on basal two-thirds of disk; strial punctures as follows: punctures of first stria round to subquadrate, separated longitudinally by half or less their diameters and very seldom by as much as their diameters, at base less than half as broad as sutural interval, becoming somewhat finer on middle of disk and again near apex as coarse as at base; second stria with the punctures coarser and denser and becoming but little finer at middle

of disk; third and fourth with the punctures coarser; stria from fourth on with the punctures nearly quadrate and broader than their respective intervals. Intervals flat on disk and with the punctures slightly coarser and sparser than microscopical punctures of pronotum. Scutellum as long as broad (·15 mm. : ·15 mm.), triangular with the sides and base rounded; feebly concave, and with the punctures similar to those of the adjacent elytral intervals. *Prosternal process* with a convex elevation not extending to base; sides moderately raised; prosternum at middle punctate as head, but with the coarse punctures much denser; on lobe the coarse punctures become finer and sparser; hypopleura punctate, similarly but more densely than anterior angles of pronotum. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process moderately strongly gibbous. Disk of metasternum flat to feebly concave; with a fine median longitudinal impression which attains neither the base nor the apex; surface with the punctures slightly finer than those of elytral intervals and seldom separated by more than their diameters; sides and pleura similarly punctate, and with the punctures round to oval, almost as coarse as punctures of hypopleura, and separated generally by once to twice their diameters. Abdomen punctate as disk of metasternum, and with round punctures as coarse as those of disk of pronotum and generally separated by two to three times their diameters; at sides these punctures become slightly coarser, deeper, and denser. Legs with microscopical punctures similar to those of pronotum; without distinct coarser punctures. *Genitalia* with the median lobe and parameres as usual in this genus, evenly narrowed to apex; median lobe nearly as long as parameres; the length ratio of the basal piece to the parameres is ·90 mm. : ·40 mm.

Female.—Externally similar to male.

Type.—Male. Foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 30 November, 1932, at light trap.

Paratypes.—Two females collected at the same locality, August 1932, one of these having been taken by beating the undergrowth; one male and two females at River Kapah, tributary of River Tinjar, 2 October, 1932, of which the male and one of the females were collected on the bark of a felled tree.

Variations.—There is little variation in body-size or in the metallic-blue colour of the elytra in the series before me. The colour of the pronotum may vary from black (as in type) to dark rufo-piceous. One female has the punctures of the pronotum and elytra slightly coarser and denser than those of the type.

Comparative Notes.—This species can only be related to *S. cyanoptera* Pasc. (1860), which is also found in Sawarak, but *cyanea* is less convex, more elongate, more parallel, and the sides of the metasternum between disk and pleuron are coarsely punctate, whereas in *cyanoptera* they are impunctate. The new species should not be confused with *S. punctiventris* Hntn., which is a smaller species (3 mm. : 4 mm. long), is more strongly convex, and is distinctly more ovate in form.

8. *Sostea thoracica*, sp. n.

Male.—Length 2·9 mm.; breadth 1·3 mm. Subparallel, moderately strongly convex. Dorsal surface clothed with fine, moderately short (about ·05 mm.), recumbent, testaceous hairs which are moderately densely distributed; also clothed with much longer and darker erect hairs which on head are occasionally ·32 mm. long, but here and on prothorax and elytra are usually about ·20 mm. long; there appears to be (in the much rubbed specimens before me) little intergradation in the two types of pubescence. Ventral surface clothed for the most part somewhat similarly to prothorax, but with the short hairs longer and the long hairs shorter and not so numerous. Cuticle shining, dark rufo-piceous; pronotum nearly black; apical segments of antennæ, mouthparts, and legs paler rufo-piceous. *Head* without distinct impressions. Surface (including clypeus) microscopically punctate, with usually nearly round punctures which are seldom separated by more than their diameters and with usually round shallow punctures which are about four times as coarse as facets of eyes (·05 mm.) and are seldom separated by more than their diameters, though on clypeus these coarser punctures become finer and sparser. *Prothorax* at broadest point near basal third broader than long (1·17 mm. : ·72 mm.), and base broader than apex (1·12 mm. : ·78 mm.). Apical margin as seen from above evenly and moderately deeply arcuately emarginate for

its entire breadth ; apical angles not prominent, acute, slightly deflexed ; sides moderately arcuate, moderately converging towards apex, lateral margins moderately coarsely, obtusely and irregularly crenate ; basal angles not prominent, nearly rectangular ; base deeply and broadly sinuate on each side and moderately rounded in front of scutellum. Pronotum with anterior four-fifths feebly transversely, moderately strongly convex. Surface with microscopical punctures similar in size and density to those of head ; coarse punctures on middle of disk similar but finer than those of head, these become slightly coarser and denser towards sides and at anterior angles are coarser than those of head and not separated by more than half their diameters. Elytra more than three times as long as prothorax (2·15 mm. : ·72 mm.), and greatest breadth across humeri nearly as great as greatest breadth, which is at apical third (1·35 mm. : 1·37 mm.). Humeri moderately strongly gibbous. Each elytron on middle of basal fifth with a broad, nearly round, very feeble gibbosity ; elsewhere without gibbosities of any sort. Lateral margins feebly and irregularly crenate. Surface striate, striæ feebly impressed on middle of disk, but more strongly impressed towards sides ; punctures of first stria nearly round and separated longitudinally by about their diameters and here half as coarse as sutural interval, becoming finer at middle of disk and again near apex as coarse as at base, punctures of striæ from first intervals outwards rapidly becoming coarser and denser, so that punctures of third stria are moslty subquadrate, and at basal third of disk are distinctly broader than third interval; at extreme base from first to fifth there is little change in the size of the punctures. Intervals flat, only microscopically punctate, but with these punctures not so dense or distinct as those of pronotum. Scutellum as long as broad (·12 mm. : ·12 mm.) and punctate as adjacent elytral intervals. *Prosternal process* with a convex elevation not extending to base ; sides moderately raised ; prosternum at middle punctate as disk of pronotum, but with the punctures much deeper and somewhat denser, and also densely microscopically punctate ; prosternal lobe with the coarse punctures finer, shallower, sparser, and also much less distinct ; microscopical punctures much sparser ; hypopleura punctate similarly, but much

more deeply than anterior angles of pronotum. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process moderately strongly gibbous. Disk of metasternum flat to feebly concave; with a scarcely noticeable median longitudinal line which attains base and apex, and at posterior fifth for a length of ·12 mm. becomes as broad as ·05 mm., and as deep as broad; surface not as coarsely or as densely microscopically punctate as pronotum, also with a few punctures as coarse as prosternal one which are mostly confined to middle sides; sides punctate as hypopleura, but with both types of punctures slightly sparser. Basal abdominal segment with the middle and extreme basal sides more finely and not as deeply punctate as middle of prosternum; second segment with the coarse punctures at middle finer and separated by four to five times their diameters, those at sides less distinct and denser; this segment and other segments with the microscopical punctures united laterally so that surface frequently appears minutely transversely strigose. Legs only with the usual microscopical punctures. *Genitalia* (apex of basal piece lost) with the parameres and median lobe evenly narrowed and pointed at apex; median lobe as long as parameres.

Female.—Unknown.

Type.—Mt. Dulit, River Koyan, 2500 feet, in primary forest beating undergrowth, 18 November, 1932.

Comparative Notes.—This species somewhat resembles *S. fryi* Grouv. (1896), but the body-form is different, the long erect hairs on dorsal surface more sparse and much more uniform, and the punctures throughout are generally coarser. From *S. secuta* Pasc. (1860) and allied species it differs in having the thorax strongly convex on anterior four-fifths, instead of moderately feebly and evenly convex throughout.

9. *Sostea fusca*, sp. n.

Male.—Length 3·8 mm.; breadth 1·7 mm. Subparallel, moderately strongly convex. Dorsal surface clothed with fine, moderately long (about ·07 mm.), recumbent to occasionally erect, slender, testaceous hairs which are dense on head, prothorax, and scutellum, and sparser on elytra, near apex of elytra being often erect;

also clothed with much longer, darker, and sparser hairs which on head are often ·50 mm long, but here and on prothorax and on elytra are usually about ·22 mm. long; there is but little intergradation between the two types of pubescence. Ventral surface clothed for the most part as pronotum, but with the shorter hairs feebly longer, finer and sparser, and with the long hairs less numerous, paler, and seldom as long as long hairs of pronotum. Cuticle shining, dark rufo-piceous; apical segments of antennæ, mouth-parts, and tarsi paler rufo-piceous. *Head* with an indefinite, shallow, oval impression on middle of vertex; elsewhere without distinct impressions. Surface microscopically punctate (about ·006 mm.) with round punctures which are seldom separated by more than their diameters and also with round punctures which are usually less than three times as coarse as facets of eyes (·05 mm.), and are separated generally by a third to once their diameters. Clypeus with the microscopical punctures similar and the coarse punctures about half as coarse as those of head and separated by one to three times their diameters; on anterior margin punctures are absent and the surface is microscopically transversely strigose. *Prothorax* at broadest point near basal third about one-third broader than long (1·45 mm. : 1·00 mm.), and base broader than apex (1·35 mm. : 1·02 mm.). Apical margin as seen from above evenly and moderately deeply arcuately emarginate for its entire breadth; apical angles moderately prominent, feebly deflexed, acute, and extreme apex shortly reflexed upwards; sides moderately arcuate, moderately converging towards apex, lateral margins coarsely and irregularly crenate with about seven crenations, which vary from being acute to obtuse; basal angles not prominent, nearly rectangular; base deeply and broadly sinuate on each side and moderately rounded in front of scutellum. Pronotum rather strongly convex on anterior three-fifths; surface with two sizes of punctures as follows: microscopical punctures similar in size and density to those of head; coarse punctures on disk of pronotum only very slightly finer and sparser than those of head, becoming finer towards base and towards sides coarser and denser. Elytra three times as long as prothorax (2·75 mm. : 1·00 mm.), and broadest point across humeri narrower than greatest breadth

across apical one-third (1·60 mm. : 1·70 mm.). Humeri strongly gibbous. Each elytron with a moderately large, oval, feebly gibbous area on basal one-fifth; elytra elsewhere without gibbosities. Lateral margin only near apex feebly and irregularly crenate. Surface striate, striæ strongly impressed on middle of disk and more strongly so towards sides; strial punctures as follows: punctures of first stria on basal half deep, round to subquadrate, separated longitudinally by about their lengths and more than half as broad as sutural interval, these punctures being finer and sparser on apical third; second stria with the punctures coarser and denser, being at middle of disk coarser than second interval and separated by less than their lengths; other stria with the punctures deeper and slightly coarser. Intervals flat to feebly convex; surface of intervals with the microscopical punctures much sparser than similar punctures of pronotum and often three times as coarse. Scutellum flat, triangular, with the sides and base rounded, broader than long (·18 mm. : ·15 mm.); surface sculptured as adjacent elytral intervals. *Prosternal* process with a convex longitudinal elevation opposite posterior half of coxæ; sides strongly raised; prosternum at middle punctate as sides of pronotal disk; lobe microscopically punctate as elytral intervals and with the coarse punctures shallow, sparse, and indistinct; hypopleura more sparsely, but otherwise similarly, punctate to sides of pronotum. Mesosternum with anterior portion of each side of the cavity for the reception of the prosternal process moderately strongly gibbous. Disk of metasternum flat to feebly concave; with a fine median longitudinal impression which is barely traceable to base and apex, but at posterior fifth is suddenly broadened to about ·12 mm. for a distance of about ·25 mm., and is deeper than broad; surface slightly more sparsely punctate than pronotum, with an occasional coarse puncture only at middle sides; sides of metasternum with a row of coarse punctures on anterior side near middle coxal cavity, and another row on trochantin of hind leg, elsewhere punctate as disk. Abdomen microscopically punctate throughout as pronotum; middle of basal segment with coarse punctures similar to those of hind trochantin; elsewhere with a few coarse punctures (as coarse as those of pronotal disk) on sides and entire

area of apical segment. Legs only with the usual microscopical punctures. *Genitalia* with the basal piece more than twice as long as parameres (·82 mm. : ·37 mm.); median lobe moderately narrowed and pointed at apex, and attaining apex of parameres; parameres very slightly narrower before apex than at apex, moderately broadly rounded at apex with the outer face of each moderately convex.

Female.—Externally similar to male.

Type.—Male. River Kapah, tributary of River Tinjar, 2 October, 1932, on bark of felled tree.

Paratypes.—One male collected by beating and one female on bark of felled tree, with same data as above; two females, one collected by beating in secondary forest, and the other on cultivated land now waste, foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 4 August, 1932.

Variations.—No variation worthy of mention has been noted.

Comparative Notes.—This species is rather close to *S. crassa* Hntn., but may be separated as follows: (1) the long erect hairs of the body are never broadened at apices as they are in *crassa*; (2) the punctures on vertex of head and anterior portion of pronotal disk in *crassa* are seldom separated by as much as a third of their diameters, whereas in the new species they are often separated by as much as their diameters; (3) in *crassa* the third elytral stria at basal third has the punctures distinctly narrower than third interval, whereas in *fusca* they are slightly broader than the third interval at the same place; and (4) the sides of the metasternum have not the strongly alutaceous microsculpture of *crassa*.

10. *Sostea insolita*, sp. n. (Figs. 1–3.)

Male.—Length 3 mm.; breadth 1·62 mm. Obovate, strongly convex. Dorsal surface clothed with fine, moderately short (about ·06 mm.), recumbent to nearly erect, testaceous, moderately dense hairs; also clothed with similar, but much longer and sparser, erect hairs, which on prothorax and head are sometimes as long as ·37 mm., but are not usually over ·17 mm. long; both types of pubescence are usually distinct, though the long hairs are occasionally a third as long as normal. Ventral

surface clothed as dorsal, but with the fine short hairs not so short and the long hairs much less numerous and seldom as long as longer ones of elytra. Cuticle shining, dark rufo-piceous; basal portion of head, prothorax, and elytra black; apical segments of antennæ, mouth-parts, and tarsi paler rufo-piceous. *Head* without distinct impressions. Surface microscopically punctate (punctures about ·006 mm. in diameter) with usually round punctures, which are usually separated by once to twice their

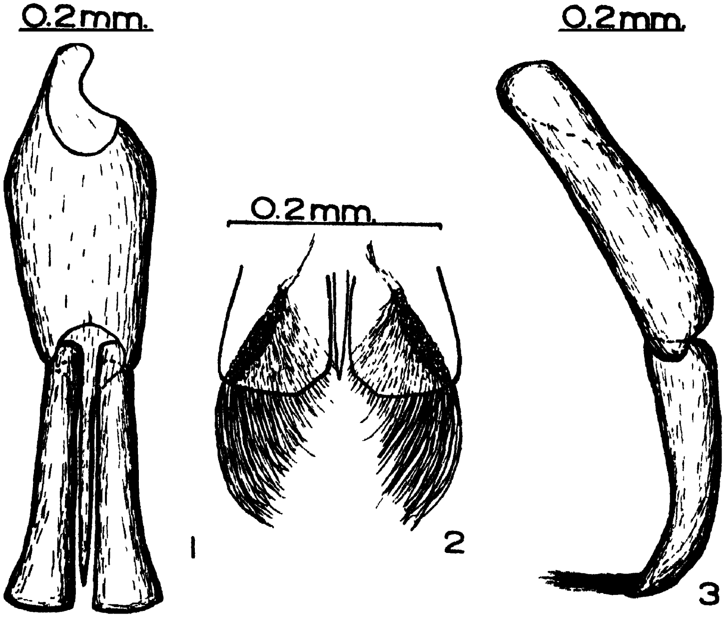

Fig. 1.—Dorsal view of male genitalia of *S. insolita*, sp. n.
Fig. 2.—Dorsal view of extreme apex of same.
Fig. 3.—Lateral view of same.

diameters; also punctate with round shallow punctures, which are indistinct and usually half again as coarse as facets of eyes (·02 mm.) and are separated generally by less than to once their diameters; clypeus with the coarse punctures finer and sparser, anteriorly microscopically transversely rugose. *Prothorax* at broadest point, which is at base, twice as broad as long (1·30 mm. : ·65 mm.), and base broader than apex (1·30 mm. : ·67 mm.).

Acoustics and the British Association.

In passing to the subject matter of this Address, I may perhaps mention that a search through the Reports of the Association reveals that throughout its entire existence of over a hundred years, no previous Presidential Address in Section A has dealt with acoustical matters. Neither can I find a precedent for an experimental address such as I am venturing to offer you to-day. It is fitting that the subject of acoustics should occupy us in this lecture theatre, which was one of Prof. Barton's last achievements.

During the course of the search, one could not fail to be impressed by the galaxy of distinguished mathematicians and physicists who have presided over our Section in the past. Here is a random selection of pre-war names: Brewster, Herschel, Forbes, Stokes, Airy, Rankine, Cayley, Wheatsone, Tyndall, Maxwell, Tait, Balfour Stewart, Lord Kelvin, Carey Foster, Johnstone Stoney, the late Lord Rayleigh, Chrystal, G. H. Darwin, Fitzgerald, Sir Oliver Lodge, Schuster, Glazebrook, Rücker, Hicks, Sir J. J. Thomson, Prof. Forsyth, Poynting, Larmor, Sir Chas. Boys, Lamb, Sir Napier Shaw, Lord Rutherford, Hobson, Turner, Callendar, Baker, Sir Frank Dyson and Prof. Whitehead.

Except for two war years (1917 and 1918), the British Association has never failed to meet annually, nor has the Section omitted to play its part. Since the war, we find further names no less eminent: Andrew Gray, Prof. O. W. Richardson, Prof. G. H. Hardy, McLennan, Sir Wm. Bragg, Sir George Simpson, Prof. Porter, Prof. Whittaker, Prof. A. Fowler, Lord Rayleigh, Sir Frank Smith, Sir J. J. Thomson, Prof. Rankine, Sir Gilbert Walker, Macdonald, Dr. Aston and Prof. Ferguson.

It was not until 1843 (twelve years after the inaugural year of the British Association) that the first Presidential Address was given to the Section of Mathematics and Physics by M'Cullagh. His lead was by no means always followed in subsequent years, and even when it was, the address had clearly assumed no particular moment. Stokes's Sectional address in 1862 seems to have occupied about four minutes, while Whewell, the renowned Master of Trinity, in the course of a brief address four years earlier at Leeds, lamented the small size of the meeting room, but on reflection thought it might suffice, as 'we in this Section are very much in the habit of treating our subjects in so sublime a manner that we thin the room very speedily.' Since about 1868, the Sectional programme has invariably included a Presidential Address, though over a long period it was given no title. Lord Kelvin, ever a stalwart supporter of the British Association, was the first to supply a title (in 1876) and kept up the practice in his later addresses, his example being followed by Sir Robert Ball in 1887. But the innovation found no other supporters, and it was not until 1911 that Prof. Turner adopted a title; since 1920 the Presidential Addresses in Section A have all borne titles.

As regards the two previous Nottingham meetings, at the first of these in 1866, Wheatstone apparently dispensed with a Sectional Address; while at the second meeting in 1893, the late Sir Richard Glazebrook gave an address on optical theories and the ether. Those who then

Apical margin as seen from above evenly and moderately deeply, arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, slightly deflexed, and feebly produced forwards; sides moderately feebly arcuate and moderately converging towards apex, lateral margins smooth, not crenate; basal angles not prominent, feebly rectangular; base deeply and broadly sinuate on each side and moderately rounded in front of scutellum, apparently entirely and very finely margined. Pronotum moderately strongly and evenly convex, not distinctly more convex on anterior portion. Surface with two sizes of punctures as follows: microscopical punctures similar to those of head and usually separated by once to twice their diameters; coarse punctures on disk similar to those of head, but deeper and more distinct, these punctures becoming slightly sparser towards base and coarser and denser towards sides, so that at middle sides the punctures are usually ·035 mm. in diameter. *Elytra* three times as long as prothorax (2·62 mm. : ·65 mm.), and from humeri moderately broadened to greatest breadth at apical two-fifths (1·37 mm. : 1·12 mm.). Humeri moderately feebly gibbous; elytra elsewhere without gibbosities of any sort. Lateral margins with only an occasional moderate crenation near apex. Surface striate, striæ very feebly impressed on middle of disk, but becoming more strongly so towards sides; strial punctures as follows: punctures of first stria round to feebly subquadrate, moderately shallow, and separated generally by less than once their diameters, at base a third as broad as sutural interval, at basal third coarser, but the proportion to the sutural interval is about the same (first stria, as usual in the convex species of this genus, from basal fifth to apical two-fifths swings out moderately, so that here sutural interval becomes broader), beyond basal third becoming slightly finer and much less distinct to near apex, where they again become coarser; punctures of second stria similar, but usually more subquadrate, and at basal third as broad as second interval; on other striæ the punctures become coarser and deeper as they approach the sides. Intervals flat on disk, feebly convex towards sides; surface much less distinctly, more sparsely, and often more coarsely punctate than microscopical punctures of

pronotum; without coarse punctures. Scutellum flat, subovate, broader than long (·15 mm. : ·12 mm.); surface sculptured as adjacent elytral intervals. *Prosternum* with the process without the usual longitudinal elevation between coxæ, prosternum between coxæ feebly concave, sides feebly raised and punctate, similarly but more densely than elytral intervals; prosternum at middle punctate as process, but with an occasional coarse indistinct puncture; lobe also similarly punctate, but with a few moderately coarse, very indistinct punctures which at sides become coarser and denser, so that they resemble punctures of discal pronotal area; hypopleura also moderately densely, microscopically punctate, and with a few punctures as coarse as coarser ones of pronotal disk. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process not noticeably gibbous. Disk of metasternum very feebly concave; with a fine median longitudinal impression extending from base to apex, but at posterior fourth suddenly broadened to a pit which is about ·06 mm. broad, as broad as long, and not as deep as broad; surface microscopically punctate, somewhat as pronotum, and also with coarse round punctures which are moderately deep, often about ·05 mm. in diameter and separated by a fourth to once their diameters; sides with a row of these coarse punctures near middle coxæ and an occasional one on hind trochantin; elsewhere microscopically, transversely, densely strigose except posteriorly near disk, where surface is microscopically punctate as on disk. Abdomen with the microscopical punctures denser than pronotal ones, and with a few coarse and indistinct punctures at base of basal segment and sides of other segments. Legs microscopically punctate as abdomen; without coarse punctures. *Genitalia* as figured (figs. 1–3).

Female.—Unknown.

Type.—Male. River Kapah, tributary of River Tinjar, 2 October, 1932, by beating.

Paratypes.—One male, foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 5 October, 1932, taken at light.

Variations.—The paratype has the prosternal process more concave and the disk of the metasternum less strongly punctate. No other variations worthy of mention have been noted.

Comparative Notes.—This species belongs to the *S. westwoodi* Pasc. (1860) group of the genus, but from all the members of this group may be immediately separated by the tuft of pubescence at the apex of each paramere (*cf.* figs. 2–3), the other species having no such tuft of pubescence.

11. *Sostea parva*, sp. n.

Male.—Length 2·8 mm.; breadth 1·5 mm. Feebly obovate, moderately strongly convex. Dorsal surface clothed with fine, moderately short (about ·05 mm.), recumbent to nearly erect, moderately dense, testaceous hairs, and also clothed with similar, but much longer, stouter, erect hairs which on head and prothorax are sometimes as long as ·32 mm., but here and on elytra are usually about ·15 mm. long; there is a slight amount of intergradation between the two types of pubescence, but they are usually quite distinct. Ventral surface somewhat similarly clothed, but with the short hairs slightly longer and denser, and the long hairs not so numerous, and seldom as long as long hairs of elytra. Cuticle moderately strongly shining, dark rufo-piceous; pronotum and elytra mostly black; apical segments of antennæ, mouth-parts, and legs paler rufo-piceous. *Head* without distinct impressions. Surface with two sizes of punctures as follows: coarse punctures generally round, shallow, and nearly as coarse as facets of eyes (·02 mm.), and separated by less than to twice their diameters; microscopical punctures less than one-fifth as coarse, indistinct, and separated by three to five times their diameters; on anterior portion of clypeus the surface is very finely transversely strigose. *Prothorax* at broadest point, which is at base, nearly twice as broad as long (1·22 mm. : ·62 mm.), and base broader than apex (1·22 mm. : ·75 mm.). Apical margin as seen from above moderately deeply and evenly arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, slightly deflexed; sides feebly arcuate, nearly straight, moderately converging towards apex, lateral margins with only an occasional very feeble crenation; basal angles not prominent, nearly rectangular; base broadly and deeply sinuate on each side and moderately rounded in front of scutellum; base at middle extremely

finely margined. Pronotum feebly convex throughout (as in all members of the *S. westwoodi* group). Surface punctate as head, but with the coarse punctures on discal regions sparser and slightly finer, but towards sides and especially near anterior angles with the punctures about a third coarser than those of head and slightly denser; fine punctures finer and less distinct than those of head. *Elytra* more than three times as long as prothorax (2·25 mm. : ·62 mm.), and from broadest point across humeri feebly broadened to greatest breadth at apical third (1·40 mm. : 1·50 mm.). Humeri moderately gibbous; elytra elsewhere without gibbosities of any sort. Lateral margins not crenate. Surface striate, striæ scarcely noticeably impressed on basal two-thirds of disk; strial punctures as follows: punctures of first stria on most convex portion of disk round to subquadrate, shallow, more than a third as broad as sutural interval on this same portion of disk and separated by half to once their diameters, towards base these punctures become slightly finer and sparser, but towards apex they rapidly become finer, and so shallow that they are indistinct from apical third to apical fifth; punctures of second stria similar, but slightly coarser and on most convex portion of disk they are slightly broader than second interval; punctures in other striæ gradually become deeper and coarser towards sides. Intervals nearly flat; surface with the punctures similar to fine ones of pronotum, but often slightly coarser. Scutellum flat, triangular, with sides and base rounded, broader than long (·12 mm. : ·10 mm.); surface punctate as adjacent elytral intervals. *Prosternal process* without a distinct median elevation between coxæ; surface generally punctate as elytral intervals, but antero-lateral portion with punctures as coarse as those of pronotal disk, but less distinct; postero-lateral portion microscopically transversely alutaceous; hypopleura punctate as antero-lateral portion of prosternum and throughout transversely alutaceous. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process moderately strongly gibbous. Disk of metasternum nearly flat, with a fine median longitudinal line extending from apex to base and apparently nowhere suddenly broadened into a deep pit (unless I am mistaking the pit for one of the

deep punctures); surface microscopically punctate as head, but more densely so, and also with moderately shallow, irregularly ovate, very coarse (about ·02 mm. to ·05 mm.) punctures, which are separated usually by much less than their lengths, and because of their density they give the surface a coarsely sub-rugose appearance; sides nearly impunctate and densely, microscopically, transversely alutaceous. Sides of basal abdominal segment alutaceous as sides of metasternum; middle of basal segment and surface of other segments occasionally feebly alutaceous, but usually punctate as elytral intervals. Legs microscopically punctate. *Genitalia* with the median lobe and parameres as usual in this genus, rather evenly narrowed to apex; when viewed laterally the genitalia is arcuately, moderately strongly curved ventrally; median lobe as long as parameres; length ratio of basal piece to parameres is ·47 mm. : ·50 mm.

Female.—Unknown.

Type.—Male. River Kapah, tributary of River Tinjar, 4 October, 1932, beating in primitive forest (*B. M. Hobby, A. W. Moore*, and *J. Ford*).

Comparative Notes.—This species is the smallest of that group of closely allied species related to *S. westwoodi*. Judging from external characters, it appears to be most closely related to *S. insolita* Hntn., but may at once be separated by the absence of a tuft of pubescence on the apex of each paramere. Like *insolita* it is rather distinctive in having the sides of the metasternum strongly transversely alutaceous (or strigose).

[To be continued.]

38

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RESULTS OF THE OXFORD UNIVERSITY EXPEDITION TO BORNEO, 1932. DRYOPIDÆ (COLEOPTERA).—PART II.

Results of the Oxford University Expedition to Borneo, 1932. Dryopidæ (*Coleoptera*).—Part II. By H. E. HINTON (Zoological Laboratory, Cambridge).

[Concluded from p. 109.]

12. *Sostea scottianus*, sp. n.

Female.—Length 4·00 mm.; breadth 2·04 mm. Feebly obovate, strongly convex. Dorsal surface clothed with fine, moderately short (about ·05 mm.), recumbent to nearly erect, moderately dense, testaceous hairs, and also clothed with longer, erect, stouter, darker hairs, which on head and prothorax are often ·45 mm. long, but here and on elytra are usually about ·15 mm. long; there is little intergradation of the two types of pubescence. Ventral surface clothed somewhat similarly to dorsal, but with the long hairs much sparser. Cuticle strongly shining, colour black, though often feebly rufo-piceous, with a distinct, though feeble, aneous lustre; apical segments of antennæ, mouth-parts, and tarsi distinctly rufo-piceous. *Head* without distinct impressions. Surface

with two sizes of punctures as follows: coarse punctures round, shallow, about as coarse as facets of eyes (·02 mm. to ·03 mm. in diameter), and usually separated by one-fourth to nearly once their diameters; on clypeus the coarse punctures are finer and not so distinct, anterior portion of clypeus finely transversely rugose. *Prothorax* at broadest point, which is at basal fourth, twice as broad as long (1·77 mm. : ·87 mm.), and base broader than apex (1·80 mm. : 1·02 mm.). Apical margin as seen from above evenly, moderately deeply, and arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, and slightly deflexed; sides feebly arcuate, moderately converging towards apex, lateral margins apparently smooth; basal angles not prominent, nearly rectangular; base bisinuate, broadly and moderately deeply sinuate on each side, and rounded in front of scutellum, base appearing under high magnification quadri-sinuate, for on each side there appears to be a very feeble secondary sinuation opposite humeral gibbosity. Pronotum very feebly transversely convex. Surface with the disk punctate as head, but much more sparsely so, the coarse punctures being here separated by one to three times their diameters and the fine punctures by two to three times their diameters; the coarse punctures become coarser towards sides, so that at sides they are nearly as dense, and, especially anteriorly, nearly a fourth coarser than those of head; on base in front of scutellum coarse punctures are slightly finer and sparser than on disk. Elytra four times as long as prothorax (3·50 mm. : ·87 mm.), and greatest breadth across humeri 2·02 mm., scarcely less than breadth at apical third. Humeri moderately strongly gibbous; elytra elsewhere without distinct gibbosities. Lateral margins apparently smooth. Surface striate, striæ feebly, but distinctly impressed on middle of disk, but becoming more strongly impressed towards apex and sides; striæ punctate as follows: punctures of first stria on most convex portion of disk obovate to rectangular, less than a fifth as broad as sutural interval on this part of disk, and separated by about once their diameters, towards base punctures become slightly finer and sparser, but towards apex beyond apical third they become rapidly finer and sparser to apical fifth, where they are again moderately coarse; punctures of second stria similar, but

very slightly coarser, and on most convex portion of disk slightly more than a third as broad as second interval; punctures of the third and fourth striæ nearly the same, but deeper (punctures as in other species of the genus becoming deeper as they approach the sides); punctures of fifth, sixth, and seventh striæ on most convex portion of disk nearly half as broad as their respective intervals; punctures of eighth stria between half and three-fourths as broad as eighth interval. Intervals flat; punctures similar to fine ones of pronotum, but slightly sparser and less distinct, and also with punctures about twice as coarse as these fine ones, which give rise to the long hairs. Scutellum nearly flat, triangular, with the sides and base rounded, broader than long (·20 mm. : ·17 mm.); surface punctate as adjacent elytral intervals. *Prosternal process* with a feeble longitudinal elevation between posterior part of coxæ; sides not distinctly raised; surface punctate as head, but lobed portion with the coarse punctures finer and less distinct at middle; hypopleura punctate similarly to antero-lateral sides of pronotum, posteriorly as well as postero-lateral part of prosternum densely and finely transversely alutaceous. Mesosternum with the anterior part of each side of the cavity for the reception of the prosternal process moderately feebly gibbous. Disk of metasternum nearly flat, median impressed line scarcely visible from base to apex, but on posterior fourth suddenly enlarged to a deep pit, which is as broad as a coarse pronotal puncture and twice as long as broad; surface of disk punctate as antero-lateral portion of pronotum, but with the punctures about one-third coarser and distinctly deeper; sides at middle without distinct coarse punctures, densely and finely, but strongly, transversely alutaceous, the alutaceous microsculpture being sparser antero-mesally. Abdominal segments densely microscopically punctate. Legs only with dense microscopical punctures.

Male.—Unknown.

Type.—Mt. Dulit, 4000 feet, 28 October, 1932, at light trap in moss forest (usual collectors and *J. Ford*).

Comparative Notes.—From all other species of the *S. westwoodi* group, to which this species belongs, it may readily be distinguished by the much finer elytral strial punctures, which are nowhere as coarse as intervals.

contributed papers included Fitzgerald, the late Lord Rayleigh, Oliver Lodge, Lord Kelvin, Barton, Larmor, Carey Foster, Viriamu Jones, and J. J. Thomson.

During the first fifty years of the Association, it was not uncommon for the Sectional Presidency to be held on more than one occasion by the same man, viz. Whewell and Lord Kelvin were each elected President on five occasions while Brewster, Herschel, the Earl of Rosse, Forbes, Stokes and the then Dean of Ely each held the office twice. Since 1884 it has become the practice for the Sectional Chair to be occupied by a newcomer. To this, there has been only one, though a very notable exception, namely Sir J. J. Thomson, who presided in 1896 and again at the memorable Centenary meeting in London in 1931.

That acoustics was long the Cinderella of the physical sciences is apparent from the sustained Presidential cold-shoulder, though even in the very earliest meetings the subject was not without its supporters. At the second meeting, at Oxford in 1832, Wheatstone read two papers on acoustics, one of them experimental. The Rev. Mr. Wills also gave 'An Account of the Recent Additions to our Knowledge of the Phænomena of Sound,' though it is recorded that the printing of the paper was deferred; which seems to have been a polite way of shelving it!

At the 1834 meeting, there was a paper by Addams on 'A New Phænomenon of Sonorous Interference' which was accompanied by an experimental demonstration. In the following year at Dublin, there were no fewer than four acoustical papers, including one by Wheatstone 'On the various Attempts which have been made to imitate Human Speech by Mechanical Means,' while in a remarkably penetrating paper 'On the Construction of Public Buildings in reference to the Communication of Sound,' Dr. Reid of Edinburgh recognised reverberation as the most prevalent acoustic defect of large rooms and explained how it could be reduced by excluding superfluous space by hanging draperies, or by making the walls more absorbent through greater roughness or irregularity. He also condemned concave surfaces as promoting uneven distribution of sound. Thus the prime and vital factors of good architectural acoustics were clearly recognised as long as a century ago, but did not reach the ear of the architectural profession, so that countless halls with poor acoustics have since been, and still are being erected. The British Association of to-day aims at a more effective publicity in all such matters of general concern.

Tyndall, during his Sectional Presidency in 1868, gave evidence before a Select Committee on the acoustics of the House of Commons, stressing the value of a low ceiling as a reinforcing device, and the beneficial influence of an audience (as in the Cambridge Senate House) or of draperies in quenching the after-sound in a room. Again, Johnstone Stoney, who was Sectional President in 1879, described in 1885 a method of treating walls to free concert halls or public rooms from echo effects.

It was the late Lord Rayleigh, our Sectional President in 1882, to whom with Helmholtz we owe the enduring foundations of a great deal of modern acoustics. Kelvin never said a truer thing when he remarked that progress in a science hinges on measurement; this indeed is the

13. *Sostea vicina*, sp. n.

Male.—Length 3·4 mm.; breadth 1·6 mm. Moderately obovate, moderately strongly convex. Dorsal surface clothed with fine, moderately short (about ·05 mm.), recumbent to nearly erect, testaceous, moderately dense hairs, and also clothed with similar, but much longer, stouter erect hairs, which on head and prothorax are sometimes as long as ·40 mm., but here and on elytra are usually about ·17 mm. long; there is a slight amount of intergradation between the two types of pubescence, but usually they are quite distinct. Ventral surface similarly clothed, but with the short hairs usually twice as long and denser, and the long hairs much less numerous and about as long or slightly shorter than long hairs of elytra. Cuticle strongly shining, black to very dark rufo-piceous; apical segments of antennæ, mouth-parts, and legs paler rufo-piceous. *Head* with a broad, feeble, longitudinal impression on vertex; elsewhere without distinct impressions. Surface with two sizes of punctures as follows: coarse punctures generally round, shallow, and about a fourth to a third coarser than facets of eyes (·02 mm.), and separated usually by one to two times their diameters, though often by less; microscopical punctures less than a fourth or fifth as coarse, often indistinct, and separated by less than to three or four times their diameters; on anterior portion of clypeus the surface is finely transversely rugose, elsewhere on clypeus with the coarse punctures much finer and less distinct than those of head. *Prothorax* at broadest point, which is at basal fourth, about twice as broad as long (1·42 mm. : ·75 mm.), and base broader than apex (1·40 mm. : ·85 mm.). Apical margin as seen from above evenly and deeply arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, slightly deflexed; sides moderately arcuate and moderately strongly converging towards apex, lateral margins apparently smooth; basal angles not prominent, feebly acute; base broadly and deeply sinuate on each side and moderately rounded in front of scutellum. Pronotum feebly convex throughout (as in all members of the *S. westwoodi* group). Surface punctate as head, but with the coarse punctures much sparser, being separated by two to three

times their diameters on disk, towards base sparser than this, but towards sides coarser and denser, so that antero-laterally they are usually about a third coarser than those of disk and are separated rarely by more than their diameters; microscopical punctures generally finer than those of head and separated by two to four times their diameters. *Elytra* more than three times as long as prothorax (2·25 mm. : ·75 mm.), and from broadest point across humeri feebly broadened to greatest breadth at apical half. Humeri moderately gibbous; elytra elsewhere without gibbosities. Lateral margins not crenate. Surface striate, striæ feebly impressed on middle of disk, but more strongly impressed towards sides; strial punctures as follows: punctures of first stria on most convex portion of disk round to quadrate, moderately shallow, more than half as broad as sutural interval on this portion of disk and separated longitudinally by about their diameters, towards base these punctures become very slightly finer and sparser, but towards apex they become rapidly finer and shallower, so that they are not distinct from before apical third to apical fifth; punctures of second stria similar, but coarser, more quadrate, and on more convex portion of disk about as broad as second interval; punctures of other striae becoming deeper and very slightly coarser as they approach lateral margins. Intervals on disk flat; surface with the punctures similar to microscopical punctures of pronotum, but more irregularly distributed and often slightly coarser. Scutellum nearly flat, triangular, with the sides and base feebly rounded, and broader than long (·15 mm. : ·12 mm.); surface sculptured as adjacent elytral intervals. *Prosternal process* feebly concave, without a median elevation between coxæ, sides broadly but feebly raised; surface feebly occasionally alutaceous, punctate with microscopical punctures similar to those of elytral intervals, but denser, and with a few round punctures about as coarse as those of pronotal base and separated by three to four times their diameters; prosternal lobe similarly punctate, but with the coarse punctures finer and less distinct at middle, laterally becoming coarser and deeper, and the alutaceous microsculpture here becoming denser; hypopleura microscopically punctate as lobe, though posteriorly the surface becomes rather strongly trans-

versely alutaceous, at middle with numerous deep round punctures, which are as coarse as pronotal punctures near anterior angles. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process very strongly gibbous. Disk of metasternum nearly flat, with a very fine, median, longitudinal line extending from base to apex, and at posterior fourth suddenly broadening out to form a deep pit which is about ·06 mm. long, about ·05 mm. broad, and not as deep as broad ; surface with the fine punctures similar to those of head, but slightly denser, and also with moderately deep, round to obovate, coarser (about ·03 mm. to ·05 mm.) punctures, which are separated by half to nearly once their diameters ; sides only with an occasional coarse puncture near disk, with a row of coarse punctures near middle coxæ, and with a few on hind trochantin and hind coxa, surface elsewhere finely, transversely alutaceous, the alutaceous microsculpture becoming sparser posteromesally. Middle basal area of basal abdominal segment with a few coarse punctures ; this segment elsewhere and other segments densely microscopically punctate with punctures which are about twice as coarse as those of head and, especially towards sides, often united laterally to each other. Legs only microscopically punctate. *Genitalia* with the median lobe and parameres as usual in this genus rather evenly narrowed to apex ; when viewed laterally the genitalia are biarcuately, moderately strongly curved ventrally ; median lobe as long as parameres ; the length ratio of the basal piece to parameres is ·72 mm. : ·55 mm.

Female.—Unknown.

Type.—River Kapah, tributary of river Tinjar, 3 October, 1932, beating in primitive forest.

Comparative Notes.—This species is most closely related to *S. parva* Hntn., from which it may be separated as follows : (1) *vicina* is a larger species (3·4 mm. : 2·8 mm.) ; (2) the punctures of the metasternum are not so dense in *vicina* as they are in *parva*, and the surface here has not the coarsely rugose appearance that it has in *parva* ; and (3) the ratio of the basal piece to the parameres of the genitalia is in the order of ·72 mm. : ·55 mm. in *vicina*, whereas in *parva* it is in the order of ·47 mm. : ·50 mm.

14. *Sostea hobbyi*, sp. n.

Male.—Length 3·6 mm.; breadth 1·7 mm. Obovate, moderately strongly convex. Dorsal surface clothed with fine, moderately short (about ·06 mm.), recumbent to nearly erect, moderately dense, testaceous hairs and also clothed with much longer, erect, stouter, and darker hairs, which on head and prothorax are ·45 mm. long, but here and on elytra are usually about ·17 mm. long; there is but little intergradation between the two types of pubescence. Ventral surface somewhat similarly clothed, but with the short hairs denser and slightly longer and the long hairs very much less numerous than longer ones of elytra. Cuticle strongly shining, moderately dark rufopiceous; head and prothorax nearly black and with a very slight though distinct æneous lustre, elytra paler and with a distinctly stronger æneous lustre. *Head* without distinct impressions. Surface with two sizes of punctures as follows: coarse punctures generally round, shallow, ranging in size from ·02 mm. to ·05 mm. (facets of eyes are about ·02 mm.), and usually separated by a fourth to once their diameters, though often confluent and here and there separated by twice their diameters; microscopical punctures about a fourth as coarse as facets of eyes, distinct and generally separated by once to slightly more than once their diameters; anterior portion of clypeus finely transversely rugose. *Prothorax* at broadest point, which is at base twice as broad as long (1·42 mm. : ·75 mm.), and base broader than apex (1·42 mm. : ·90 mm.). Apical margin as seen from above moderately deeply and evenly arcuately emarginate for its entire breadth; apical angles not prominent, feebly acute, slightly deflexed; sides feebly acute, moderately strongly converging towards apex, lateral margins smooth; basal angles not prominent, nearly rectangular; base moderately deeply and broadly sinuate on each side, and rounded in front of scutellum, but appearing (under magnification of $\times 144$) quadri-sinuate, for there appears to be on each side a very feeble sinuation opposite humeral gibbosity, base apparently extremely finely and completely margined. Pronotum very feebly more convex on anterior four-fifths than is usual in the *westwoodi* group of this genus. Surface punctate as head, but

with coarse punctures on disk as fine or smaller (·02 mm.) than coarse punctures of head and sparser, being generally separated by one to three times their diameters, towards base these become slightly sparser and towards sides slightly coarser and denser, so that near anterior angles they are as coarse as coarsest punctures of head and but slightly sparser ; microscopical punctures generally similar to those of head, but on disk slightly sparser. *Elytra* more than three times as long as prothorax (2·90 mm. : ·75 mm.), and from broadest point across humeri feebly broadened to greatest breadth at apical third (1·60 mm. : 1·70 mm.). Humeri moderately feebly gibbous ; elytra elsewhere without gibbosities of any sort. Lateral margins feebly and indistinctly crenate near apex, elsewhere smooth. Surface striate, striæ on middle of disk absent or not noticeably impressed, but towards sides feebly distinctly impressed ; strial punctures as follows : punctures of first stria on most convex portion on disk shallow, round to subquadrate, slightly less than half as broad as sutural interval, and separated longitudinally by about or slightly less than their diameters, towards base these punctures become slightly finer, but towards apex they become rapidly finer from apical half to apical fifth, becoming beyond apical fifth again moderately coarse ; punctures of second stria similar, but slightly coarser, and on most convex portion of disk about two-thirds as broad as second interval ; punctures of other striæ similar, but becoming deeper and slightly coarser, and from fifth stria on the punctures are often as broad as their respective intervals on discal region. Intervals flat on disk ; surface with microscopical punctures very much sparser and more irregularly distributed than those of pronotum, and often about twice or three times as coarse. Scutellum feebly concave, triangular, with the sides and base rounded, as long as broad (·12 mm. : ·12 mm.); surface more densely punctate than adjacent intervals. *Prosternal process* without a distinct median elevation between coxæ ; surface punctate as elytral intervals, but slightly more densely so, and also with deep, round to obovate, coarse (some are almost ·06 mm. in diameter) punctures, which are seldom separated by more than their diameters and are usually so dense that they give the surface a coarsely subrugose appearance ; prosternal

lobe similarly punctate, though on middle area with the coarse punctures finer, less distinct, and much sparser; hypopleura punctate rather similarly to prosternum between front coxæ, posterior portion and postero-lateral portion of lobe with the usual transverse alutaceous microsculpture rather feebly developed. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process moderately strongly gibbous. Disk of metasternum nearly flat, with a fine median longitudinal line extending from apex to base, and at posterior two-fifths suddenly broadened into an oblong impression which is about ·21 mm. long, at broadest point about ·07 mm. and at deepest point almost as deep as broad; surface for a short distance on each side of the median line without coarse punctures, though with fine punctures similar but denser than those of prosternum, towards sides of disk coarsely and as densely punctate as prosternum between front coxæ; sides with a few of these coarse punctures near middle coxal cavities, and a few on hind coxæ, sides of metasternum densely, microscopically, transversely alutaceous, though posterior mesal portion is finely punctate as middle of disk. Basal abdominal segment with a few coarse punctures at middle of base and a few more very indistinct ones at sides of other segments and apical region of apical segment; fine punctures similar to those of metasternum, but often united laterally to each other, sides of basal segment with longitudinal alutaceous microsculpture which very gradually fades away posteriorly, and is only very indistinctly present on sides of other abdominal segments. Legs microscopically punctate throughout. *Genitalia* with the median lobe and parameres as usual in this genus rather feebly and evenly narrowed towards apex; when viewed laterally the genitalia are strongly arcuately curved ventrally; median lobe as long as parameres; length ratio of basal piece to parameres is ·87 mm. : ·37 mm.

Female.—Not known.

Type.—Male. River Kapah, tributary of River Tinjar, 1 October, 1932, beating undergrowth in primitive forest.

Comparative Notes.—This species may be readily known by its very differently proportioned genitalia, which have the parameres less than half as long as the basal

piece. The structure of the metasternal disk is also different from that on any other species in the *westwoodi* group, particularly as regards the structure of the very large pit on the median line.

15. *Sostea confusa*, sp. n.

Male.—Length 3·8 mm.; breadth 1·9 mm. Moderately obovate, rather strongly convex. Dorsal surface clothed with fine, moderately short (about ·06 mm.), recumbent to nearly erect, moderately dense, testaceous hairs and also clothed with similar, but much longer, stouter, erect hairs, which on head and prothorax are sometimes as long as ·35 mm., but here and on elytra are usually about ·2 mm. long; in the specimen before me (which is evidently very rubbed) there is scarcely any intergradation between the two types of pubescence. Ventral surface similarly clothed, but with the short hairs slightly longer and the long hairs less numerous. Cuticle moderately strongly shining, black to very dark rufo-piceous and with a feeble æneous lustre; apical segments of antennæ, mouth-parts, and tarsi as usual paler. *Head* without distinct impressions. Surface with two sizes of punctures as follows: coarse punctures generally round, moderately deep, and slightly but distinctly coarser (about ·02 mm.) than facets of eyes and separated usually by about a third to once their diameters; microscopical punctures about a sixth or more as coarse, distinct, and separated generally by two to three times their diameters; clypeus with the coarse punctures finer, sparser, and less distinct, anterior portion benig finely transversely and densely rugose. *Prothorax* at broadest point, which is at base, nearly twice as broad as long (1·60 mm. : ·85 mm.), and base broader than apex (1·60 mm. : 1·00). Apical margin as seen from above deeply and moderately evenly arcuately emarginate for its entire breadth; apical angles slightly prominent, feebly acute, and slightly deflexed; sides feebly arcuate, moderately converging towards apex, lateral margins very feebly irregularly crenate; basal angles not prominent, nearly rectangular; base broadly and deeply sinuate on each side and moderately rounded in front of scutellum. Pronotum feebly transversely convex, but more strongly convex than is usual in the *westwoodi* group of this genus. Surface punctate as head,

but with the coarse punctures on disk coarser (often ·37 mm. in diameter and deeper than usual in the *westwoodi* group) and much more evenly distributed, being nearly always separated by one-half to once their diameters, on basal region in front of scutellum these punctures are slightly coarser, towards sides they are also slightly coarser and at anterior angles denser than anywhere else on disk, and not noticeably coarser than those in front of scutellum; microscopical punctures distinct, and usually separated by two to four times their diameters. *Elytra* more than three times as long as prothorax (3·15 mm. : ·85 mm.), and from humeri feebly broadened to greatest breadth at apical third (1·87 mm. : 1·90 mm.). Humeri rather strongly gibbous; elytra elsewhere without gibbosities of any sort. Lateral margins not crenate. Surface striate, striae absent or nearly so on basal two-thirds of disk, towards sides and apex more distinctly impressed; strial punctures as follows: punctures of first stria on most convex portion of disk nearly round, from one-half to two-thirds as coarse as sutural interval on this same portion of disk and separated longitudinally by slightly more than their diameters, towards base remaining about equally as coarse, but towards apex they rapidly become finer, so that they are indistinct from apical half to apical fifth, at apical fifth becoming again coarser and deeper; punctures of second stria about equally as coarse on most convex portion of disk, and here (due to fact that second interval is narrower than sutural) they are slightly coarser than second interval, towards base these punctures become about half as coarse as punctures of sutural stria; other stria with the punctures similar to those of second interval, but becoming deeper as they approach the sides; punctures of third, fourth, and fifth striæ being seldom as coarse as their respective intervals, punctures of sixth and remainder of striæ on basal portion generally as coarse or slightly coarser than their respective intervals. Intervals generally flat, at apex feebly convex as usual in this genus; surface microscopically punctate, but these much sparser, much less regularly distributed, and often three times as coarse as those of pronotum (the coarser punctures here give rise to the long setæ). Scutellum flat, triangular, with the sides and base rounded, broader than long (·15 mm. :

·12 mm.); surface slightly more densely punctate than adjacent elytral intervals. *Prosternal process* broader than usual, with a broad, feebly convex line extending between front coxæ, sides not noticeably raised, surface with fine punctures denser than those of elytral intervals and coarse punctures similar but about a fifth coarser than coarsest punctures of pronotum, deeper, and on each side of median line separated by about half their diameters; prosternal lobe similarly punctate, but with the coarse punctures much finer and sparser except at extreme postero-lateral sides where they are as coarse and dense as on pronotal disk, and the surface here is transversely, microscopically, densely alutaceous; hypopleura sculptured similarly to postero-lateral portion of prosternum, but nowhere except at extreme posterior portion with the distinct alutaceous microsculpture. Mesosternum with the anterior portion of each side of the cavity for the reception of the prosternal process moderately strongly gibbous. Disk of metasternum feebly concave, with a fine, median, longitudinal line extending from base to apex and at posterior third suddenly broadened into a suboval pit which is about ·20 mm. long, slightly narrower than long, and about a third as deep as broad; surface at middle generally free of coarse punctures, at sides coarse punctures often coarser than those between front coxæ, and as dense, though very irregularly distributed, fine punctures similar to those of prosternum; sides with a few very dense coarse punctures near middle coxæ, trochantin with similar coarse punctures from disk halfway to sides, hind coxa with a few coarse punctures; sides of metasternum (except for row of coarse punctures near middle coxæ) microscopically, transversely, densely alutaceous, though on postero-mesal portion it is punctate as on disk. Middle of basal portion of basal abdominal segment with coarse punctures sparser, but otherwise similar to those of head; segments elsewhere with a few coarse punctures similar to those which give rise to the long elytral hairs, and very densely punctate, with fine punctures which are finer than finest of pronotum, and are generally transversely lengthened and often united laterally to each other. Legs microscopically punctate throughout. *Genitalia* with the median lobe and parameres as usual in this

genus feebly and evenly narrowed towards apex ; when viewed laterally the genitalia are strongly curved ventrally; median lobe as long as parameres ; length ratio of basal piece to parameres is ·85 mm. : ·72 mm.

Female.—Unknown.

Type.—Male. Foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 19 August, 1932, collected on cultivated land now waste.

Comparative Notes.—In the structure of the genitalia and by its general body-shape, this species is apparently very closely related to *S. parva* Hntn. and *S. vicina* Hntn., but from *parva* it differs in its larger size (3·8 mm. : 2·8 mm.), coarser and denser coarse punctures of pronotum, and in the basal piece being longer than the parameres, whereas in *parva* it is shorter. From *S. vicina* it differs in its slightly larger size (3·8 mm. : 3·4 mm.), coarser and much denser coarse punctures of pronotum, and punctures of fourth and fifth elytral striæ are seldom as broad as their respective intervals, while in *vicina* they are always on most convex portion (region of basal fourth to apical half) as broad or broader than their respective intervals.

Larinæ.

16. *Potamophilinus gravastellus*, sp. n.
(Figs. 4 & 5.)

Female.—Length 4·2 mm. ; breadth 1·65 mm. Elongate, subparallel, feebly convex. Dorsal surface densly clothed throughout with fine, short (about ·05 mm.), erect to recumbent, greyish-testaceous hairs. Ventral surface similarly clothed, but with the hairs often slightly longer. Cuticle feebly shining, nigro-cinereous ; mouthparts and claws rufo-piceous ; basal two segments of antennæ, basal parts of legs, and middle portion of ventral surface somewhat fulvous. *Head* with the narrowest portion between eyes (near antennal bases) slightly narrower than the greatest diameter of an eye (which is in a longitudinal direction) (·36 mm. : ·40 mm.) ; with a feebly broad, indefinite, longitudinal impression on each side near eyes. Surface microscopically, densely punctate. *Prothorax* at broadest point, which is at basal fifth, one-fourth broader than long (1·25 mm. : ·90 mm.),

keynote of the new motto of the British Association 'Sed omnia disposuisti' (But Thou hast ordered all things in measure and number and weight.) Rayleigh was almost alone in his day in improvising with rare simplicity and skill measuring devices in acoustics. But in many ways his voice was one crying in the wilderness, for until the telephone came into general use, acoustics had been of little service to the people, and there was small interest in the subject at either schools or Universities. Many of us will recall the shabby treatment meted out to sound in the physics curricula of those days.

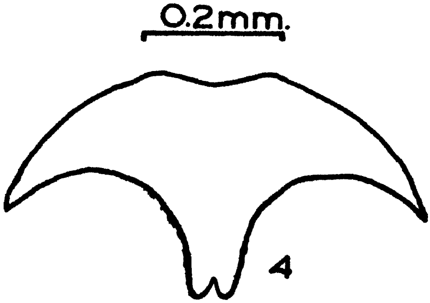
The touchstone came with the thermionic valve, which led to electrical methods of measurement and so to higher precision, as elsewhere in physics. The gramophone, wireless, broadcasting and the talking pictures followed each other in succession; and now acoustics, far from being a Cinderella, has become a radiant Princess of physics in whose career the public interest has become completely enchained. Her 'open sesame' revealed the interior of the Abbey last May to countless millions, who were vouchsafed a vivid acoustic imagery of the Coronation ceremony. For such technical miracles, no praise can be too high for the skilled army of technical and industrial workers who see to it that developments in invention, equipment and technique follow each other like a river in spate. The literature is immense, and I can only surmise that the commercial value of applied acoustics must run into many millions of pounds. At any rate, I can testify, as its Chairman, that a Committee of the British Standards Institution was occupied for nearly two years in the careful scrutiny and compilation of a glossary of the large and steadily expanding acoustical terminology. So much acoustical research is now being carried out, that an authoritative glossary, particularly in the matter of units, is manifestly of the first importance in the comparison of experimental results from different laboratories and the application of such data to engineering acoustics. Sound has become a marketable commodity the cultural and political developments of which, particularly in regard to broadcasting, are not easy to envisage.

Noise and the Nation.

Simultaneously with these developments in applied acoustics, there has gradually developed in this country a public consciousness of the insidious growth of the social evil of needless noise—a pernicious by-product attributable in great part to an increasingly mechanised civilisation. With this growing realisation, the nation is beginning to demand and to receive protection against the nuisance of outrageous noise whether generated by private or public bodies. It is looking for ways and means of mitigating excessive transport noises particularly on the road and in the air, and it is seeking to know why in modern houses or flats it should not be accorded adequate privacy against the natural though sometimes unreasonable noises of neighbours.

All this is not to say that John Citizen cherishes the ideal of a completely silent world, for due noise in due season unquestionably contributes to the spice of life. It should indeed be emphasised that in this matter he

and base broader than apex (1·20 mm. : ·75 mm.). Apical margin moderately strongly and broadly arcuate in front and very feebly sinuate on each side behind eye before apical angle ; apical angles not prominent, feebly obtuse ; sides strongly arcuate on basal third, from basal third to apex moderately strongly converging towards apex, and feebly sinuate on apical fourth, lateral margins not crenate ; basal angles feebly obtuse, not produced, feebly turned inwards ; base trisinuate, broadly and moderately feebly sinuate on each side, and similarly, but narrowly, sinuate in front of scutellum. Pronotum nearly flat on disk, with a complete, moderately feeble, broad, transverse impression on apical fourth ; on basal angles and extending to apical two-thirds is a suboval,



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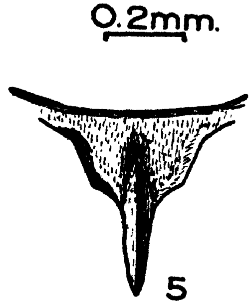

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Fig. 4.—Ventral view of sixth ventral abdominal segment of *Potamophilinus gravastellus* Hntn.
Fig. 5.—Ventral view of prosternum of same.

deep, definitely delimited impression, which is as broad as long. Surface similarly, but slightly more coarsely punctate than head. *Elytra* more than three times as long as prothorax (3·07 mm. : ·90 mm.). Humeri moderately gibbous. Each elytron on suture before apex with a broadly rounded, upwardly reflexed projection ; inner apex feebly rounded, not produced, and towards sides feebly, but noticeably, sinuate and thence broadly rounded to lateral margins. Surface striate, striæ moderately coarse and well marked with the usual stria interposed between sutural and second on basal fourth ; discal strial punctures round to subquadrate, generally separated longitudinally by their lengths or slightly less and usually more than a third as broad as intervals. Alternate intervals on disk scarcely noticeably convex, others

flat; sutural interval moderately strongly convex from basal fifth to apex; seventh interval moderately strongly convex from humeri to apical third; surface of intervals similarly, but more finely punctate than head. Scutellum feebly convex, triangular, with the sides and base feebly rounded, broader than long (·22 mm. : ·18 mm.); surface sculptured as adjacent elytral intervals. Surface beneath and legs punctate throughout as elytra. Prosternal process as figured (fig. 5) (the elevation extending along process arises at base more gradually than is shown in the figure); metasternum with a fine, complete, median longitudinal line; disk on each side moderately convex. Fifth abdominal segment moderately narrowly and very shallowly sinuate at apex; sixth as figured (fig. 4).

Male.—Unknown.

Type.—Female. Foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 2 September, 1932, at trap light.

Comparative Notes.—In my key to the species of *Potamophilinus* (1935). this species traces to *P. perplexus* Waterh. (1876) of Java, but differs in having the sutural interval convex instead of flat.

Elminæ.

17. *Stenelmis semifumosus*, sp. n. (Fig. 8.)

Female.—Length 3·6 mm.; breadth 1·2 mm. Subparallel, moderately convex. Dorsal surface clothed with extremely short, dense, suberect to recumbent, testaceous hairs, and with a few larger (about ·03 mm.) hairs sparsely distributed; middle portion of ventral surface similarly but more sparsely setose. Cuticle subopaque, rufopiceous; head except anterior portion of labrum nearly black; pronotum blackish brown to often distinctly rufous; elytra brownish cinereous except for a large blood-red patch occupying the first three intervals on apical third and extending anteriorly and posteriorly as a narrow line on the inner margin of the sutural interval; hypopleura and femora coloured as pronotum. *Head* with a feebly indefinite impression on each side near eyes, and with a slightly gibbous portion on middle of head just in front of antennal bases; anterior margin of clypeus truncate; anterior margin of labrum feebly rounded. Surface strongly alutaceous, and except for labrum with

round granules which are finer than facets of eyes, and are usually separated by three to four times their diameters; basal portion of labrum impunctate, apical portion punctate with fine obscure punctures, which are separated by less than twice their diameters. Antennæ attaining basal sixth of pronotum. *Prothorax* at greatest breadth, which is near basal third, narrower than long (·92 mm. : ·95 mm.), and base broader than apex (·77 mm. : ·67 mm.). Apical margin as seen from above strongly arcuate and deeply sinuate on each side behind eye before apical angle; apical angles acute, strongly produced forwards; sides moderately arcuate at basal third, more feebly so elsewhere, lateral margins feebly crenate; basal angles feebly acute, not prominent; base broadly and moderately strongly sinuate on each side, and truncate in front of scutellum. Pronotum with an oblong gibbous area in front of scutellum, on each side of this gibbous portion with a puncture about twice as coarse as a facet of an eye, and on anterior portion of gibbous area begins a shallow parallel-sided impression, which is about as broad as apex of basal antennal segment, and becomes less distinct anteriorly, so that it is hardly discernible at apical half; on each side beginning close to lateral margin on basal half and extending obliquely posteriorly to basal fourth of median impression is a broad, barely preceptible impression; elsewhere not evenly convex, but without distinct impressions. Surface strongly alutaceous, and with the punctures, which are about two to three times as coarse as facets of eyes, round and seldom separated by more than twice their diameters; anteriorly at sides these punctures are coarser and often confluent; at sides near base with a few granules about as coarse as facets of eyes, and separated generally by two to three times their diameters. *Elytra* more than twice as long as prothorax (2·25 mm. : ·95 mm.), and feebly broadening posteriorly to greatest breadth at apical third, which is broader than base of prothorax (1·20 mm. : ·77 mm.). Humeri moderately gibbous. Apices moderately produced, conjointly narrowly rounded. Lateral margins not distinctly crenate (mag. of $\times 144$). Surface striate, with the second stria becoming obsolete at about apical fourth; discal strial punctures subquadrate to round, on middle of disk separated longitudinally by about

their diameters, and about two-thirds as coarse as intervals, towards sides punctures become coarser and denser. Discal intervals apparently flat, third ending at extreme base in a prominent tubercle-like projection, which is feebly turned mesally; sixth and eighth intervals only very feebly elevated; surface of intervals strongly alutaceous and without distinct punctures. Scutellum flat, ovate, with the base nearly truncate, as broad as long (·15 mm. : ·15 mm.) and twice as broad as sutural interval; surface sculptured as adjacent intervals. *Prosternum* as figured (fig. 8), flat at middle, lobe beginning at anterior third; middle portion obscurely rugose-punctate, the punctures being about as coarse as those of anterior sides of pronotum, and usually confluent. Metasternum with a large, deep, sharply defined impression occupying most of middle and a portion of anterior area of metasternum. Metasternum with a median longitudinal impression, which is about as broad as base of basal antennal segment, moderately deep and extending to depressed anterior portion; near posterior margin feebly and broadly depressed; surface of disk strongly alutaceous and punctate as disk of pronotum, sides more finely punctate, but otherwise similarly sculptured. Abdomen with a short sulcus on each side of basal portion of process of basal segment, the sulcus extending about two-thirds of the length of the segment at that point; apical segment feebly depressed and feebly emarginate at middle of apex; surface more finely and distinctly punctate than anterior middle of pronotal disk.

Male.—Unknown.

Type.—Foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 1 October, 1932, at sheet light.

Paratype.—One female with same data as above, but collected 6 October, 1932.

Comparative Notes.—This species is most closely related to *S. semirubrum* Reitt. (1899) of Sumatra, but may be separated by not having the first interval elevated at base.

18. *Cyllœpus marshalli*, sp. n.
(Figs. 6, 7, 9, 10, 11, & 12.)

Male.—Length 3·7 mm.; breadth 1·5 mm. Moderately elongate, subparallel, moderately convex. Dorsal surface with only a few long (usually less than ·12 mm.), erect,

sparsely distributed setæ. Ventral surface and legs with more numerous, but much shorter, finer, and recumbent setæ. Cuticle shining, testaceous; head black, except for posterior portion of labrum; pronotum and elytra with black markings as figured (figs. 6 & 9); hypopleura, sides of prosternum, mesosternum, and metasternum black to very dark testaceous, sides of abdomen

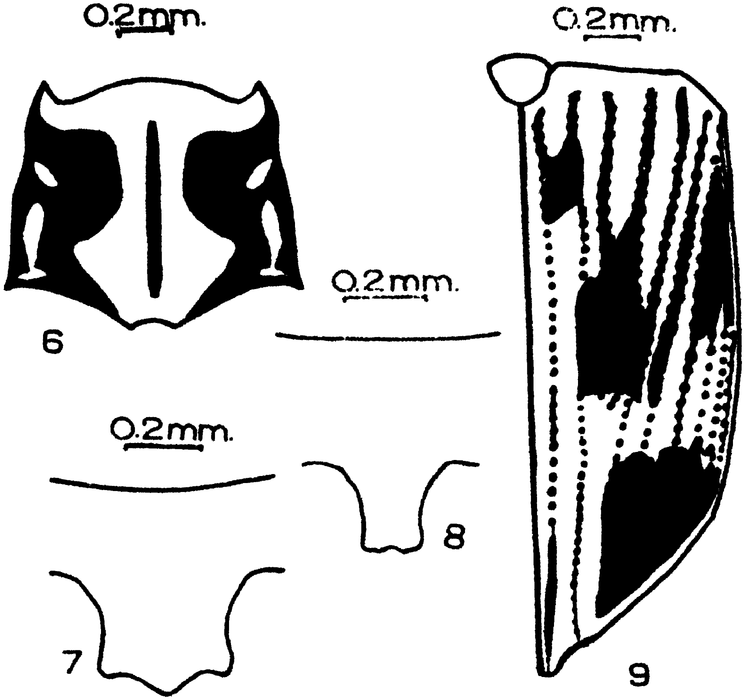


Fig. 6.—Pronotum of *Cyllœpus marshalli* Hntn., showing maculation.
Fig. 7.—Ventral view of prosternum of same.
Fig. 8.—Ventral view of prosternum of *Stenelmis semifumosus* Hntn.
Fig. 9.—Dorsal view of left elytron of *Cyllœpus marshalli* Hntn., showing maculation.

and apical portion of apical segment black; posterior basal portion of front legs and anterior basal portion of middle and hind legs black, upper basal portion of all tibiæ nearly black. *Head* rugose-punctate on vertex, and here and elsewhere with punctures whch are usually half as coarse as granules of eyes and are seldom separated by as much as twice their diameters; anterior clypeal

margin truncate; anterior margin of labrum nearly truncate; antennæ attaining basal fifth of prothorax. Prothorax at broadest point across basal angles slightly broader than long (1·12 mm. : 1·02 mm.), and base broader than apex (1·12 mm. : ·75 mm.). Apical margin as seen from above strongly arcuate and deeply sinuate on each side behind eye before apical angle; apical angles strongly produced forwards, and feebly reflexed inwards and downwards; sides nearly straight, feebly sinuate in front of basal angles and slightly more strongly sinuate near apical one-fourth, margins not crenate; basal angles very feebly produced and feebly acute; base trisinuate, very broadly and feebly sinuate on each side, narrowly and shallowly sinuate in front of scutellum. Pronotum with a shallow parallel-sided sulcus about as broad as basal part of third antennal segment extending from basal one-fifth to apical one-fifth; elsewhere evenly convex, without other impressions. Surface with shallow round to oval punctures, which are not as coarse as facets of eyes and are seldom separated by more than their diameters and are often confluent, towards sides of disk punctures may be about twice as coarse and so dense that they give the surface a slightly rugose appearance. *Elytra* more than twice as long as prothorax (2·50 mm. : 1·02 mm.), and very feebly broadened posteriorly to broadest point at apical third, which is broader than base of prothorax (1·5 mm. : 1·12 mm.). Humeri feebly gibbous, obliquely truncate. Apices feebly produced, broadly conjointly rounded, but extreme apex feebly dehiscent. Lateral margins regularly and moderately coarsely crenate. Surface striate-punctate, with the striæ becoming coarser towards apex, and third and fourth striæ terminating slightly beyohd basal half; discal strial punctures round to feebly subquadrate, moderately shallow, and longitudinally confluent to separated by as much as once their diameters; basal discal strial punctures are one-fourth to one-third as broad as intervals, but punctures of second to sixth discal intervals on basal fourth to apical half are generally very dense and nearly as broad as intervals (intervals are here about two-thirds as broad as sutural interval at base). Surface densely but obscurely rugose-punctate, the punctures being as fine as those of head. Scutellum nearly round, twice as

broad as sutural interval at base, slightly broader than long (·21 mm. : ·18 mm.), nearly truncate basally, and feebly narrowed at apex. Surface feebly concave; sculptured as adjacent portion of elytral interval. *Prosternal process* as figured (fig. 7), sides feebly elevated, middle nearly flat, lobe beginning before anterior fifth; surface somewhat more coarsely rugose-punctate than elytra. Metasternum with a fine median longitudinal

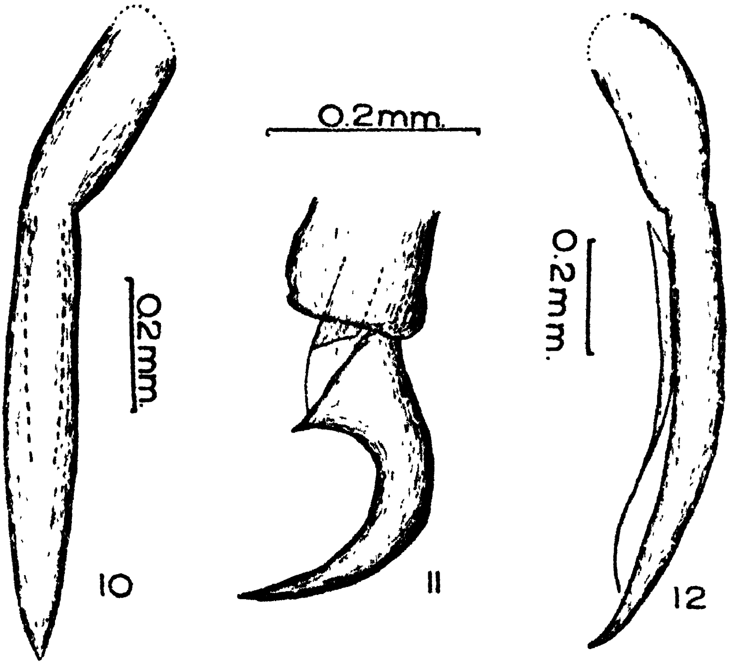


Fig. 10.—Dorsal view of male genitalia of *Cyllœpus marshalli* Hntn.
Fig. 11.—One of the hind claws of the same.
Fig. 12.—Lateral view of male genitalia of the same.

impression nearly attaining anterior margin; surface uneven, but nowhere strongly depressed, with a few indistinct punctures. Abdomen with the basal segment very shallowly and evenly depressed, apical segment narrowly, moderately deeply emarginate, and with a tuft of hairs on each side of the emargination. Surface sculptured similarly to metasternum. Each claw with an acute basal tooth (fig. 11). *Genitalia* as figured (figs. 10, 11, & 12).

Female.—Unknown.

Type.—Foot of Mt. Dulit, junction of Rivers Tinjar and Lejok, 22 September, 1932.

Comparative Notes.—I have placed this species in the genus *Cyllœpus* more because its nearest relative, *C. bouchardi*, was so placed by Grouvelle, and because it seems to fit nowhere else, than because it shows any special relationship with the American species of *Cyllœpus*. From time to time congeneric species have been described in the genus *Stenelmis*, but it seems likely that a new genus will have to be erected separating these species, all possessing a fringe of tomentum on the inner apices of the tibiæ, from the typical members of *Stenelmis*, all of which have no fringe on tomentum on the tibiæ. From *Cyllœpus* proper the species allied to *C. marshalli* differ in having the elytra without any interval even as much as moderately strongly convex, in having the claws toothed, and in having the parameres of the male genitalia so fused dorsally that all trace of a suture has disappeared and the median lobe is no longer visible from a dorsal view.

C. marshalli is smaller than *bouchardi* (3·7 mm. : ·5 mm.), and is differently maculated (*cf.* figs. 6 & 9). In figs. 10 & 12 the dotted portion is a reconstruction of the basal piece which was broken off. The sutures at the bases of the parameres were not drawn, as they could not be seen distinctly.

39

From the ANNALS AND MAGAZINE OF NATURAL HISTORY, Ser. 10, vol. xx. p. 505, *November* 1937.

Results of the Oxford University Expedition to Sarawak (Borneo), 1932.—Brenthidæ *und* Lycidæ (*Coleoptera*).

Von R. KLEINE, Stettin.

DAS Material stammt im wesentlichen vom Fuss des Mt. Dulit. Ich habe schon verschiedene Ausbeuten vom Mt. Dulit bearbeitet. So hatte Dr. E. Mjöberg vor einigen Jahren eine Anzahl Brenthidæ und Lycidæ mitgebracht. Schon diese kleine Anzahl von Individuen liess darauf schliessen, dass die Fauna der höheren Lagen von der des Tieflandes verschieden sein musste. Wenigstens bei den Lycidæ. Die Brenthidæ gehen nicht allzuhoch ins Gebirge und ihre Formen ändern sich nicht. Eigentliche Gebirgstiere gibt es also nicht. Da die Brenthiden an holzartige Pflanzen gebunden sind, ist ihrer Ausbreitung bestimmte Grenzen gesetzt. Diese Einschränkung fällt für die Lycidæ fort. Sie steigen hoch ins Gebirge und entwickeln sich noch, sofern die bescheidenste Menge pflanzlicher Detritus zur Verfügung steht. Die von der Oxford-Expedition mitgebrachten Lyciden sind ausgesprochene Tieflandstiere und lassen die abweichenden Formen der höheren Lagen nicht ahnen.

Brenthidæ.

STEREODERMINI.

Cerobates sumatranus Senna.

Bull. Soc. Ent. Ital. xxv. 1893, p. 306.

Foot of Mt. Dulit; junction of rivers Tinjar and Lejok, 3. viii. 32. Unterholz im schlechtgehaltenen Forst. Soviel mir bekannt, leben die *Cerobates* als Räuber oder Mitbewohner bei anderen Holzkäfern. 1 Exemplar.

TRACHELIZINI.

Miolispa cruciata Senna.

Not. Leyd. Mus. xx. 1898, p. 69.

Gleicher Fundort, 10. ix. 32. 1 ♂.

Hypomiolispa sponsa Kleine.

Ent. Blätter, xiv. 1918, p. 324.

Gleicher Fundort, 11. x. 32, 1 ♀ an einer Waldlichtung gefangen.

Microtrachelizus tabaci Senna.

Bull. Soc. Ent. Ital. xxv. 1893, p. 323.

Am Licht gefangen am 25. viii. 32. 1 ♂.

Microtrachelizus rudis, sp. n.

Pechbraun, am ganzen Körper glänzend. Kopf breiter als lang, Mittelfurche tief, nach dem Halse dreieckig erweitert, filzig, Oberseite einzeln, aber kräftig punktiert; Wangen knotig verdickt, filzig. Metarostrum tief dreifurchig, auf dem Mesorostrum erweitert sich die Furche und geht noch auf die Basis des Prorostrums über, Punktierung deutlich. Mittlere Fühlerglieder etwas breiter als lang, 9. und 10. tonnenförmig. 11. nicht so lang wie das 9. und 10. zusammen. Prothorax eiförmig-elliptisch, am Halse nicht verengt, Mittelfurche in den hinteren 2/5 breit, tief und filzig, sonst schmal, flach, zart; Punktierung einzeln aber kräftig. Auf den Elytren ist die 2. Rippe nur im Hinterrandsteil vorhanden, die 8. im vorderen Drittel fehlend. Rippen und Furchen scharfkantig getrennt, auf den ersteren abstehend, borstig, einzeln behaart. Metasternum, 1. und 2. Abdominalsegment kräftig längsgefurcht und stark punktiert, 5. mit einer flachen Platte und dichter Punktierung am Hinterrand.

Länge: 6 mm. Breite (Prothorax): 1 mm. circa.

Sarawak: foot of Mt. Dulit; junction of rivers Tinjar and Lejok, 12. ix. 32. An gefälltem Holz.

Typus im Britischen Museum.

Diese robuste Art gehört mit ihrem dreifurchigen Metarostrum in meine Abteilung 1, in der sich aber keine behaarte Art befindet. Eine entfernte Aehnlichkeit besteht mit *tabaci* Senna, aber *rudis* ist viel gröber, massiger in der Gestalt, auffallend stark glänzend und vor allen Dingen behaart. Aus der Abteilung 2 Arten mit nur einer Furche auf dem Metarostrum käme noch *imbecillus* Kln. in Frage. Deren Kopf ist aber ungefurcht, das 9. und 10. Fühlerglied ist perlig und die Elytren sind lang behaart. Ausserdem handelt es sich um eine æthiopische Art, die also garnicht in Frage kommt.

is not crying for the moon. The most he needs ask of a particular locality is that its background of noise, whether by day or night, shall be suited to the environment and the reasonable habits of a majority of its occupants.

In this matter of noise abatement, the British Association has played a leading part, through the intermediary of both this Section and the Engineering Section which set up a Noise Committee in 1933. The subject has since become one of international concern, as is evidenced by the formation of a League of Nations Commission which held its first meeting at Geneva in June this year, and over which I had the honour to preside.

On the question of what constitutes a noise, it is difficult to generalise. The countryman votes the noises of the city as disturbing to a degree, nor does the townsman necessarily find a lullaby in the noises peculiar to the countryside. Many offending noises owe their origin to ill-timed activities or pure thoughtlessness. The young person hearing the raucous horn with which a friend announces his arrival has no doubt as to its character : neither has the invalid next door. A hearer is in fact patently influenced by psychological and other factors such as background, environment or force of association. There are those, moreover, who have no hesitation in regarding any sound made by some one else as an objectionable noise, while in contrast there are others who seem quite immune to noise and incidentally behave as if they find silence intolerable. Healthy children obviously revel in noise, at any rate of their own making, and the observation appears to apply to many of a larger growth who are in exuberant health, not excluding the Latin races.

The prejudicial effects of certain extremely noisy occupations on the hearing are recognised, but it would appear that the noises encountered in ordinary everyday life are unlikely to impair the hearing, though there is some evidence that in certain types of work they may adversely affect human efficiency. Most mental workers and particularly mathematicians would agree, I think, that noise is an impossible environment to work in. But while many forthright statements have been made about the effects of noise—and no one would withhold sympathy from those unfortunates whose sleep is regularly violated by noise—the root of the matter is probably that for a good many people noise aggravates rather than initiates psychological distress, being a sort of ' last straw ' for the sick, the fatigued, or the highly strung. The emotionally stable, on the other hand, have clearly a considerable power of accommodation and can get so used to certain classes of noise as never to notice them, though, were the noises arrested, they would not only quickly miss them but might even, on occasion, confess to an unexpected feeling of relief.

Without doubt then, while there are noises in the world so inappropriate or outrageous as to raise protest alike from the average hearer, the relatively immune, or the hypersensitive, there are equally many border-line sounds on which we should expect them to express very different opinions. In some recent annoyance tests on motor horns at the National Physical Laboratory, in which some two or three hundred observers were employed, it was interesting to note the divergency of views under like conditions of hearing. There was, it is true, a considerable consensus of opinion in

Carcinopisthius interrupticosta Senna.

Ann. Mus. Civ. Stor. Nat. Gen. (2) xix. (xxxix.), 1898, p. 224.

Unter Borke gefällter Bäume, 5. ix. 32, 27. viii. 32. 3 ♂♂.

ARRHENODINI.

Prophthalmus longirostris Gyllenhal.

In: Schoenherr Gen. Curc. i. 1833, p. 323.

Unter Borke gefällter Bäume, 5, 12, 13. ix. 32. 3 ♂♂, 1 ♀.

Prophthalmus tridentatus Fabricius.

Syst. El. ii. 1801, p. 554.

River Tinjar between Lejok and Rumah Bulan Ding, 2. x. und 9. xi. 32.

Mt. Dulit, R. Koyan, 2500′, primary forest, 2. x. und 17. xi. 32. 2 ♂♂, 2 ♀♀.

Barγrrhynchus dehiscens Gyllenhal.

In: Schoenherr Gen. Curc. i. 1833, p. 324.

Mt. Dulit, R. Koyan, 2500′, primary forest, 16. xi. 32.
Tinjar to Ruman Bulan Ding Riverside, 4–12. xi. 32.
Mt. Kalulong, 2. xi. 32.
R. Kapah, trib. of R. Tinjar, 24. x. 32.
Mehrere Stücke in beiden Geschlechtern.

Stratiorrhina major Calabresi.

Bull. Soc. Ent. Ital. liii. 1921, p. 47, f. 3.

Foot of Mt. Dulit, 7. x. und 19. viii. 32.

1 ♂, 1 ♀. Das ist die interessanteste Art. Sie ist selten und nur in wenigen Stücken bekannt.

Pseudorychodes tenuirostris Senna.

Ann. Soc. Ent. Belg. xxxviii. 1894, p. 376.

Foot of Dulit an toten Bäumen, 6 und 27. viii., 7. x. 32. 3 ♂♂, 1 ♀.

Hemiorychodes dissonus Kleine.

Ind. For. Rec. xi. 4, 1925, p. 146, t. 2, f. 29.

Foot of Mt. Dulit, 9.–10. ix. 32. Bisher von Borneo noch nicht nachgewiesen. 3 ♂♂, 1 ♀.

Belopherini.

Ectocemus cinnamomi Herbst.

In : Füessly, Arch. Ent. iv. 1783, p. 76, t. 24, f. 20.

Mt. Dulit, 4000′, Moss forest, 2. ix. 32 ; R. Koyan, 2500′, 16. xi. 32 ; R. Kapah, trib. of R. Tinjar, 26. x. 32. 3 ♂♂, 2 ♀♀.

Ithystenini.

Diurus furcillatus Gyllenhal.

In : Schoenherr Gen. Curc. i. 1833, p. 359.

Foot of Dulit, 14. ix. und 6. x. 32. 2 ♀♀.

Pseudoceocephalini.

Opisthenoplus madens Lacordaire.

Gen. Col. vii. 1866, p. 455, nota 2.

Foot of Mt. Dulit unter Borke gefällter Bäume. 9. viii. 32. 1 ♀.

Lycidæ.

Dictyopterini.

Pyropterus sculpturatus C. O. Waterhouse.

Trans. Ent. Soc. Lond. 1878, i. p. 112.

Sarawak, R. Kapah, trib. of R. Tinjar.

Cladophorini.

Conderis signicollis Kirsch.

Mitt. Zool. Mus. Dresden, i. 1875, p. 36.

Mt. Dulit, 2500′.

Taphes brevicollis C. O. Waterhouse.

Trans. Ent. Soc. Lond. i. 1878, p. 111.

Sarawak : R. Kapah, trib. of R. Tinjar.

Bulenides indus Kirsch.

Mitt. Zool. Mus. Dresden, i. 1875, p. 36.

Foot of Mt. Dulit.

Cautires dissentaneus Kleine.

Arch. Nat. xcii. 1926, A. 12, p. 123, t. 1, f. 24–25.

Foot of Mt. Dulit, Mt. Dulit, 2500′, Sarawak: R. Kapah, trib. of R. Tinjar.

Typische Art von Borneo. Ziemlich variabel.

Cautires pajanicus Kleine.

Stett. Ent. Zeit. lxxxix. 1928, p. 322, t. 2, f. 24–26.

Foot of Mt. Dulit, Mt. Dulit, 4000′, Moss forest, Mt. Dulit, R. Koyan, 2500′, primary forest.

Das ist die einzige ausgesprochene Gebirgsart, die schon Dr. Mjöberg aus hohen Lagen mitgebracht hat. Sie ist nur von Borneo bekannt. Also ein Gebirgstier.

Dilophotini.

Dilophotes comes Kleine.

Philipp. Journ. Sc. xxxi. 1, 1926, p. 76, t. 3, f. 15–17.

Foot of Mt. Dulit.

Die Art ist von den Philippinen bekannt geworden. Sie kommt aber auch auf Borneo vor. So fand sie Fuller-Baker auch bei Sandakan. Immerhin ist die Zahl der Lycidæ, die auf Borneo und den Philippinen zugleich lebt, nicht gross.

Dilophotes pulchellus Kleine.

Journ. Sarawak Mus. iii. 3, nr. 10, 1926, p. 360.

Mt. Dulit, 4000′.

Das Auffinden dieser Art ist wichtig. Es ist ein Gebirgstier und nur aus Höhenlagen bekannt geworden. Die Art ist übrigens auch selten.

RESULTS OF THE OXFORD UNIVERSITY EXPEDITION TO BORNEO, 1932.*

A NEW SPECIES OF *DIHAMMUS* THOMS. (COLEOPTERA, CERAMBYCIDAE).

BY DR. S. BREUNING.

Dihammus dentiferoides nov. sp.

Body elongate, narrow; antennae slender, nearly twice as long as the body (♀), the scape moderately long, narrow, with an incomplete cicatrix, the third joint about half as long again as the scape, distinctly longer than the fourth; the lower lobes of the eyes a little longer than broad, much longer than the mandibles; front rectangular, higher than broad, finely punctured, as is the vertex. Pronotum transverse, furnished at the middle of each side with a moderately long tubercle, disc finely punctured; scutellum rather long, rounded at apex; elytra elongate, subparallel, rounded at apices, closely, moderately strongly punctured, the punctures very fine towards the apex, arranged more or less in longitudinal rows on the basal half; prosternal and mesosternal processes narrow.

Colour reddish-brown, entirely covered with an olivaceous-grey pubescence; the apical half of the antennal joints, beginning with the third, fuscous.

Long. 12 mm., lat. 3.5 mm.

Type, 1 ♀ from Borneo, Sarawak, Mt. Dulit, 1,650 m., moss forest, 19.x.1932 (*Messrs B. M. Hobby and A. W. Moore*). Type in British Museum (Nat. Hist.).

Closely allied to *D. dentifer* Aur. from Mindanao, but in this species the third joint of the antenna is twice as long as the scape, the lateral tooth of the pronotum is distinctly longer, the elytra are slightly truncate at apex, finely granulate at base, the punctures are not arranged in longitudinal lines; the scutellum is clothed with a dense ochraceous-yellow pubescence, contrasting strongly with the general colour of the insect; the antennae are covered with the same olivaceous-grey pubescence as the whole surface.

18 Prinz-Eugenstrasse, Vienna, IV.
January 22nd, 1936.

B

ON A COLLECTION OF HUMBLE-BEES (*BOMBUS* AND *PSITHYRUS*, HYMENOPTERA) FROM CARA ISLAND, ARGYLLSHIRE.

BY O. W. RICHARDS, M.A., D.SC., F.R.E.S.

Through the kindness of Dr. B. M. Hobby, I have been able to study a collection of Humble-bees made in 1935 on Cara Island, Argyllshire (about 54° N., 5¾° W.) by Mr. G. Swynnerton. The island is a small isolated one lying just off Gigha. It rises to a height of 185 feet and is quite treeless.

* For a general account of this expedition see T. H. Harrisson, 1933, Geographical Journal, 82: 385-410.

Bombus Latreille.

B. lucorum (L.), 2 ♀♀ 1.vii, 3 ♀♀ 8.vii, 1 ♀ 9.vii; ***B. jonellus*** (Kby.), 2 ♀♀ 8.vii, fairly normal specimens of the typical form; ***B. lapidarius*** (L.), 1 ♀ 9.vii; *B. soroensis* (Fab.), 2 ♀♀ 2.vii; ***B. hortorum*** (L.), 2 ☿☿, 2.vii and 11.vii; ***B. muscorum pallidus*** Evans 1 ♀ 1.vii, 1 ☿ 2.vii, 2 ☿☿ 8.vii; ***B. agrorum septentrionalis*** Vogt, 1 ♀ 2 ☿☿ 2.vii, 6 ☿☿ 8.vii.

Psithyrus Lep.

Ps. campestris (Pz.) var. **swynnertoni** var.n.

♀. The hairs are black; half the hairs of the vertical tuft yellow, half black; mesonotum, except for a slight intermixture on disc, and mesopleuron ochreous; tergite 1 ochreous, black mixed at sides; 2 black with small lateral tufts on the apical quarter bright yellow; 3 with large lateral yellow tufts covering the whole length of the tergite at the sides; 4 mainly yellow, with a large baso-discal black lunule: 5 even more yellow, basal lunule smaller; venter with long pale hairs; legs black haired; wings rather dark; hairs a little longer than in specimens from S. England. Length 19 mm.

♂. The hairs are black; those of the tuft on vertex yellow; mesonotum yellow with an indeterminate black discal patch; mesopleuron yellow; hairs of abdomen yellow, disc of tergite 6 and most of tergite 7 black haired, sternite 6 with long lateral tufts largely black; legs black haired, considerably intermixed with pale hairs beneath the mid and hind femora; wings nearly hyaline; hairs a little longer and denser than in S. English specimens. L. 19 m.

Type ♀, Cara Island, 9.vii (Dept. of Entomology, Oxford Univ. Museum); allotype ♂, Loch Sween, Argyllshire, 25.viii.20 (Perkins coll., Oxford Univ. Museum); paratypes 4 ♀♀, Cara Is., 8.vii. 35 (three in Oxford Univ. Museum, two in my collection), 1 ♀, 'Scotland' (British Museum), 1 ♀, 2 ♂♂, Loch Sween, viii.20 (Perkins coll., Oxford Univ. Museum).

The British Museum female has rather fewer yellow hairs on abdominal tergites 1 and 2.

Mr. F. Allen (Map Curator at the Royal Geographical Society) kindly informs me that Loch Sween is in Argyllshire, the head of the loch being at 56° 2′ N. and 5° 35′ W. (*i.e.* very near Cara Island).

Females of *Psithyrus campestris* with as many or nearly as many yellow hairs turn up occasionally in various parts of Europe. They appear to be very rare, or at least to form only an insignificant part of the whole population; as a rule they have not been described in any detail.

The present form is apparently the only type of the species where it occurs and will probably be found to be a geographical race associating with the pale form *septentrionalis* Vogt of *B. agrorum* (Fab.). Apparently, however, the *Psithyrus* has a much less extensive range than its supposed host. Dr. R. C. L. Perkins,

F.R.S., has already mentioned and briefly described the Loch Sween specimens (1921, Ent. Mon. Mag., **57**: 82-83) without giving them a name.

There is still need for more data as to the distribution of *Ps. campestris* (Pz.) in Scotland. Mr. K. J. Morton, of Edinburgh, has very kindly sent me information as to all the records he has knowledge of, and Mr. A. R. Waterston informs me that there are no Scottish specimens in the Royal Scottish Museum (specimens in the Cameron collection purporting to belong to this species were *Ps. sylvestris* Lep. with one *Ps. bohemicus* (Seidl)).

Scottish records:—(1) In the Evans coll. (examined by Mr. Morton), 1 ♂, Loch Sween (Morton), 1 ♂, Dumfries (Service), both apparently of the var. *swynnertoni*. (2) In coll. Morton, a series of males and a few females, Loch Sween. (3) Moray (det. F. Smith) (Gordon, 1887, Scottish Nat.: 178). (4) St. Fillans, Mid Perth (det. E. Saunders) (Rothney, 1906, Ent. Mon. Mag., **42**: 14). The specimens on which the last two records were based are not available for study. According to Mr. Morton, the species does not occur in the Forth drainage area. The most northerly English record is from Carlisle (Routledge, 1933, Trans. Carlisle Nat. Hist. Soc., **5**: 99).

29A Edith Road, London, W.14.
March 31st, 1936.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxii.

C

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxii.

Sminthurides schotti Axels. (*Collembola*) *in Oxfordshire.*—This minute species of Springtail (male .25 mm., female .4 mm. in length), occurred in considerable numbers in a collection of Collembola sent me for determination by Mr. J. Ford (New College, Oxford). They were obtained during a soil investigation, and were collected in the soil from a meadow at Headington Wick, near Oxford. The insects were very plentiful in both sexes, and Mr. Ford tells me that they seem to prefer an exposed habitat, the soil being very poor and only sparsely covered, while they were much less plentiful in adjacent areas well covered with plants.

This is, I believe, only the third British record for this species, the two previous ones being: Weardale, Durham, from *Sphagnum* (R. S. Bagnall, as var. ***bilineata*** Axels., 'Vasculum,' 1921, p. 14); Myrfaen, N. Wales, in soil under moss (W. M. Davies, 'E.M.M.,' 1934, p. 93).—James M. Brown, 176 Carter Knowle Road, Sheffield: *April 7th*, 1936.

41

RESULTS OF THE OXFORD UNIVERSITY EXPEDITION TO SARAWAK (BORNEO), 1932.* THREE NEW SPECIES OF LAMIINAE (COLEOPTERA, CERAMBYCIDAE).

BY DR. S. BREUNING.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiii.

Mimocacia gen. nov.

Of elongate-ovate shape; antennae a little shorter than the body, fringed beneath; scape very long, slender, furnished at apex with a laterally prominent cicatrix, third joint much longer than the fourth, as long as the scape; antennary tubercles flat; eyes divided, the inferior lobes much longer than broad, more than twice as long as the cheeks; front as broad as high; prothorax twice as broad as long, convex, rounded and unarmed at sides; elytra elongate, very convex, much broader than the prothorax, broadly rounded at apex; prosternal process narrow, regularly rounded; mesosternal process inclined, regularly rounded; legs rather short, the femora clavate, the middle tibiae without notch on outer margin, the claws divergent.

Type: *M. ferruginea* sp. nov. Allied to *Cacia* Newm.

Mimocacia ferruginea sp. nov.

Head, prothorax and elytra very densely and finely punctured. Black, covered with ferruginous pubescence, the whole surface sprinkled with very numerous minute black spots. Legs and antennae dark brown; the legs, the first three joints of antennae and the base of the fourth to sixth joints varied with ferruginous; elytra with a broad transverse yellowish band a little before the middle. Length, 7 mm.; breadth, 2.75 mm.

BORNEO, Sarawak, base of Mt Dulit, junction of the rivers Tinjar and Lejok. Type in the British Museum (Natural History).

Mispila parallela sp. nov.

Of very elongate, cylindrical form; antennae slender, a third longer than the body, fringed beneath, the third joint a little shorter than the scape, the fourth nearly twice as long as the third; the inferior lobe of eyes a little longer than broad, twice as long as the cheeks; front broader than high, densely and finely punctate; prothorax transverse, rounded and unarmed laterally, very finely punctate on the sides; elytra very elongate, parallel-sided, rounded at apex, densely, rather strongly punctured, the punctures finer on the posterior half.

Black, covered with dark brown pubescence, the surface varied with ochreous; on each elytron several small pale yellow spots, especially one discal spot at the commencement of the basal fourth, and others forming two transverse, very undulated lines, one before and one behind the middle; the base of the joints of antennae, commencing with the third, clothed with a paler pubescence. Length, 8.5 mm.; breadth, 2.5 mm.

BORNEO, Sarawak, Mt. Dulit. Type in the British Museum (Natural History).

Dystasia valida sp. nov.

Near *D. circulata* Pasc., but of broader build, scape of antennae more enlarged at apex; prothorax shorter, with a large obtuse prominence on each

* For a general account of this expedition see T. H. Harrisson, 1933, 'Geographical Journal,' 82, 385-410.

most cases, but a proportion of the observers would as blithely vote the noise of a particular horn as very objectionable as others would just as cheerfully class it as tolerable or agreeable. The experiments, in fact, supported the view that the appraisement of noise is a matter of personal opinion ; and this aspect is endorsed by the British Standard Glossary which defines noise as ' sound undesired by the recipient.' Small blame then if some of us find it difficult to distinguish between noise and certain modern music.

Complaints against noise are of course an old story, probably as old as civilisation itself. While the acoustic conditions in the Ark do not appear to have been put on record, there are numerous later Biblical references to noise : Moses speaks of the ' noise of them that sing,' David refers to ' the noise of water spouts ' and elsewhere enjoins us to ' sing and make a joyful noise,' while Jeremiah bemoans that ' The noise is come . . . to make the cities of Judah desolate and a den of dragons.' Juvenal wrote (A.D. 47) of the cost of buying sleep in Rome owing to the noise of herds of cattle and rumbling waggons in the narrow winding streets. The Oxford Dictionary gives a reference to ' noyse ' dating from 1297 : ' Of trompes and of tabors ye sarazins made here so gret noyse that cristinemen al destourbed were.'

The clatter of the medieval town provoked restrictive regulations ; we find embargoes on nocturnal horn blowing and wife beating in Elizabeth's reign. The tumult of the streets is well illustrated by a picture painted by Hogarth in 1741. In some towns in Germany noisy occupations were zoned, though it is on record that Christian Thomasius (born 1655) objected to the privilege of the learned professions of driving from the neighbourhood noisy craftsmen, e.g. blacksmiths and musicians : he held the view that those living in a city should accustom themselves to its noise. Frederick the Great's famous and unsuccessful protest against the noise of the Mill of Sans Souci will be recalled. A hundred years ago, Jane Austen was graphically describing the traffic bedlam of Bath. Complaints from City churches of the noise of stage coaches were common in those days ; many of us are of course well aware of how noisy steel tyres and horse shoes can be on cobbles or stone or granite setts, and how great was the measure of relief which came with the introduction of the pneumatic tyre.

The Measurement of Noise.

It is common knowledge that most noises are complex in character, containing a variety of components which may be distributed over the entire auditory ranges of frequency and intensity. Such a physical constitution lends itself to objective measurement and analysis, but there are, in addition, subjective factors of prime importance to the listener, viz. pitch, timbre and loudness, and these sensations are not readily appraisable. Experience indicates, however, that while the composition of a noise is not to be ignored, sheer loudness is the determining factor in most cases of annoyance caused by noise, so that the problem largely resolves itself into the correlation of the sensation of noisiness (as assessed

side of the disc; elytra more elongate, the apical marginal angles more prominent, very finely granulate at extreme base, strongly punctured on basal third, more elevated at base, the shoulders more prominent.

The longitudinal brown bands on the surface are darker, the antemedian whitish transverse band on each elytron is a little broader and not so regular; there is no longitudinal whitish band near the suture, within the shoulders there is only one longitudinal whitish band; this band is wider and shorter and does not extend beyond the transverse band; the apical fourth of the third and fourth and the apical half of the following antennal joints clothed with darker brown pubescence. Length, 19 mm.; breath, 8 mm.

BORNEO, Sarawak, Mt. Dulit, 1,300 m. Type in the British Museum (Natural History).

Wien.

September, 1936.

RESULTS OF THE OXFORD UNIVERSITY EXPEDITION TO SARAWAK (BORNEO), 1932. BEMBICINAE (HYMENOPTERA).

BY PROF. J. B. PARKER.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiii.

Bembex melancholica Smith.

Bembex melancholica Smith, Cat. Hym. Ins. Brit. Mus., Vol. 4, 1856, p. 328 — Handlirsch, Sitsz. Akad. Wissensch. Wien, Math.-Nat. Cl., Vol. 102, 1893, p. 783 — Dalla Torre, Cat. Hym., Vol. 8, 1897, p. 508.

The genus *Bembex* is represented by a single species, *Bembex melancholica* Smith. Of the fifteen specimens belonging to this species four are females and eleven are males. From a careful examination of these we obtain the following data: all females have the dorsal maculations a light shade of yellow; have the fascia on tergite 1 interrupted at dorsal midline; have a U-shaped

discal mark on the scutum, usually broken into lines; have a pair of black discal spots enclosed by the fascia on tergite 2; and have the maculations on the sternites reduced to small lateral spots restricted to sternites 2 and 3. On one female the fascia on tergite 5 is continuous; on the others this fascia is more or less widely interrupted. The purplish iridescence on the tergites is well marked.

On the males the dorsal maculations are not yellow—they are a soiled or clay-tinted white. The fascia on tergite 1 is invariably continuous, although much narrowed at dorsal midline on some specimens. The U-shaped discal mark on the scutum is always broken into lines or into lines and spots. The fasciae on tergites 2 and 3 enclose each a pair of black discal spots and on one specimen the fasciae on all tergites exclusive of the seventh enclose paired discal spots. The fascia on tergite 6 may or may not be continuous and tergite 7 may or may not bear a pair of lateral maculations. The lateral spots on the sternites are more extensive than on the females but the purplish iridescence, although present, is less evident than on the females. On the seventh tergite there is a weakly developed but quite evident lateral ridge above and distinct from the lateral margin of the tergite. The antenna and the genitalia of the male are as figured by Handlirsch in his description of this species.

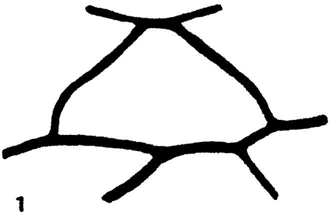
Each of these specimens bears the following label: 'Sarawak: Claudetown, 25.vii.1932.'

The genus *Bembicinus* is represented by two species that I have described as new. In doing this I am fully aware that I run a great risk of simply adding to the synonymy in this group. I have pursued this course, however, because of the conviction that of the two alternatives it is better to add to the synonymy than to place in a great collection a group of misidentified specimens. So many species in this group, in many cases based on a single specimen and frequently distinguished from another only by such variable differences as size of body or extent of maculations, have been described from the region of which Borneo forms a part, that I find it impossible to refer these wasps to any of those species with assurance I am making no mistake. That many of the species of Stizini now described from the Oriental region will in time be reduced to synonymy seems to me to be inevitable. Until someone can examine all the types of these numerous species and work out the correct synonymy, confusion is bound to prevail in this field. The description of the two species follows.

Bembicinus sarawakensis n.sp.

Type (female)—Black: apical margin of labrum, median triangular spot on frons below insertion of antennae, scape below, spot on anterior border of pronotum, fascia on posterior border of pronotum interrupted at midline, tubercles, spot on tegula, small spot on posterior lateral angle of scutum, lateral spots on scutellum, transverse median spot on metanotum, posterior lateral angles of propodeum, fascia on tergite 1 widely interrupted at midline, those on 2 and 4 continuous, obscure median spot on tergite 5, small lateral spots on sternite 2, spot distally below on anterior and middle femora, line on anterior surface of all tibiae, anterior tarsus except posterior border, *yellow*.

The flagellum is testaceous below and without special modifications. The inner eye-margins converge towards the clypeus (fig. 5), the distance between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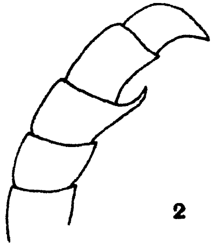
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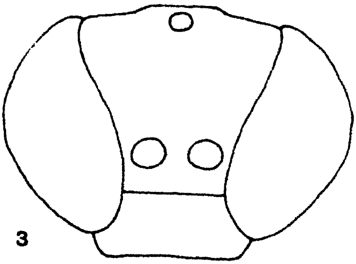
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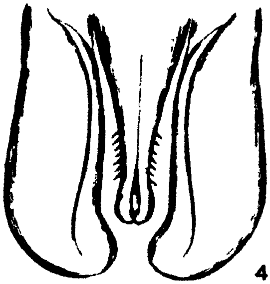
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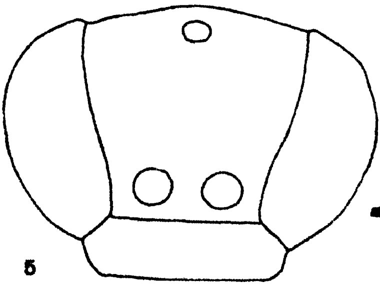
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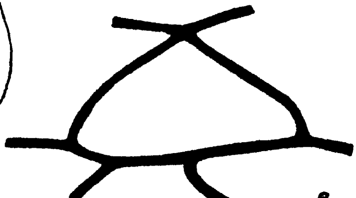
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FIG. 1.—Second cubital cell of front wing of *Bembecinus stenaspis* n.sp. ♂. FIG. 2.—Tip of antenna of *B. stenaspis* n.sp. ♂. FIG. 3.—Frons of *B. stenaspis* n.sp. ♂. FIG. 4.—Genitalia of *B. stenaspis* n.sp. ♂. FIG. 5.—Frons of *B. sarawakensis* n.sp. ♀. FIG. 6.—Second cubital cell of front wing of *B. sarawakensis* n.sp. ♀.

them at the dorsal border of the clypeus being to that at the vertex as 1 is to 1.5. The distance between the insertion of the antenna and the adjacent eye-margin is only slightly greater than the distance between the insertion and the dorsal border of the clypeus. The posterior surface of the propodeum is only slightly curved and its posterior lateral angles are rounded and without excision. The wings are hyaline and the first and second transverse cubital veins join the radius at approximately the same point (fig. 6). The punctation is minute, close and regular. The pubescence is sparse, short and white, being most prominent on the labrum and clypeus, to which it imparts a silvery sheen. All segments of the posterior tarsus are black above, the black colour being less intense below. The first and fifth segments of the middle tarsus are black, the intervening segments being much lighter in colour. Of the anterior tarsus only the posterior border of the segments is black, the black area being greatest on the first segment and the black colour decreasing in intensity from the first segment to the last. Length 10 mm.

This species is described from ten specimens (females) among which there is some variation in size. Although there is considerable variation among them in respect to the extent to which the maculations are developed, there is but little in respect to their fundamental pattern. On one specimen the fasciae on the tergites are continuous and on this same individual there is a small spot on the posterior border of the third and also of the fifth tergite. On this same specimen, however, the labrum is entirely black. On another specimen we find these same characters with respect to the tergites but with the yellow margin of the labrum developed to a greater extent than that on the type. On many of the specimens also the points of junction of the first and second intercubital veins with the radial are more widely separated than they are on the type.

The type and three of the paratypes each bear labels giving the following data: 'Rubber garden,' 'Medium shady,' 'Sarawak: Claudetown, 27.vii.1932.' 'Oxford Univ. Exp. A. W. Moore. B.M. 1933-254.' Labels on the remaining six give the following data: 'Nesting in shady path.' 'Sarawak: Claudetown, 26.vii. 1932.' 'Oxford Univ. Exp. B. M. Hobby and A. W. Moore. B.M. 1933-254.'

Type in the British Museum.

Bembicinus stenaspis n.sp.

Type (male)—Black: labrum, small median spot at base of clypeus, frons below antennae, scape below, narrow anterior orbits extending from below to only a short distance above the level of the insertion of the antennae, large spot on anterior border of pronotum, fascia on posterior border of pronotum narrowed at the midline, tubercles, fascia on either side of scutum not reaching anterior border, pair of narrow discal lines on scutum, spot on tegula and

one at base of anterior wing, large lateral spots on scutellum, conspicuous median transverse spot on metanotum, prominent spot on posterior lateral angle of propodeum, fascia on posterior border of each of the tergites 1—6, that on tergite 1 somewhat emarginate at anterior middle and broader and farther removed from the posterior margin of the tergite than are the others, median spot on tergite 7, narrow fascia on each of the sternites 2—5 obscured more or less at the midline, spot on the distal end of the femora, tibiae in greater part and tarsi, *yellow*.

The wings are not infumated, although they are somewhat darkened by the abundance of minute hairs on the surface. The first and second transverse cubital veins join the radius independently (fig. 1). The flagellum (fig. 2) is testaceous below. The inner eye-margins are strongly convergent at the clypeus, where the distance between them is to the distance between them at the vertex as 1 is to 2.2 (fig. 3). The insertion of the antenna is more than twice as far removed from the dorsal border of the clypeus as from the inner margin of the adjacent eye. The punctation is minute, close and regular. The pubescence is short. It is densest and most conspicuous on the labrum and clypeus, to which it imparts a conspicuous silvery sheen. This same silvery appearance is present on the lower part of the frons. The posterior surface of the propodeum is only slightly curved and its posterior lateral angles are prominent, rounded and show no trace of excision. The body, particularly the abdomen, shows a purplish or violet iridescence. Genitalia as in fig. 4. Length 10 mm.

Allotype (female).—The female is smaller than the male and the maculations are everywhere reduced in size except on the clypeus, where the yellow is much more extensive, forming a broad band on the dorsal and lateral borders, whereas on the labrum the yellow is confined to the apical border. The yellow on the lower part of the frons is reduced to a small triangular spot below the antennae. On the scutum the discal spots are lacking and the lateral fasciae are reduced to lateral spots.

The fascia on tergite 1 is widely interrupted and that on tergite 2 is narrowly interrupted at the midline. The fascia on tergite 3 is reduced to a narrow median spot and that on 5 to widely separated lateral spots. Only sternite 2 bears lateral spots and the yellow on the legs is less extensive than on the type. The distance between the inner eye-margins at the clypeus is to the distance between them at the vertex as 1 is to 2.5. Length 7 mm.

A second female (paratype) differs from the allotype in having the third tergite destitute of maculations and in having lateral spots on sternites 2 and 3. Length 8 mm.

Described from three specimens each bearing labels giving the following data: 'Nesting in sandy path.' 'Sarawak: Claudetown, 26.vii.1932.' 'Oxford Univ. Exp. B. M. Hobby and A. W. Moore.'

Type in the British Museum.

The Catholic University of America,
Washington, D.C.

April 12th, 1937.

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 10, vol. xix. p. 441, *April* 1937.

New Species and Records of Mutillidæ (*Hymenoptera*) *from Borneo and the Solomon Islands* *. By CLARENCE E. MICKEL, University of Minnesota.

THE Mutillidæ described and recorded herein are the results of the collecting of the Oxford University Expedition to Sarawak in 1932, of Mr. G. E. Bryant in Sarawak in 1913 and 1914, and of Mr. H. T. Pagden in the Solomon Islands in 1933 and 1934. A general account of the work of the Oxford University Expedition to Sarawak has been given by T. H. Harrisson (1933), and some of the ecological results of the Expedition have been reported by P. W. Richards (1936). G. E. Bryant (1919) gives an interesting account of his collecting experiences in Sarawak and the localities where he collected. H. T. Pagden collected a large number of Hymenoptera during the period of his residence in the Solomon Islands, and sent the Mutillidæ to me from time to time for study. Complete historical and synonymical references for all the previously described species mentioned herein, together with keys for their identification, are to be found in a paper by Mickel (1935).

I am indebted to Dr. B. M. Hobby for the opportunity of studying the Mutillidæ of the Oxford University Expedition to Sarawak, to Mr. R. B. Benson and the British Museum (Natural History) for the privilege of studying Mr. G. E. Bryant's material and for assistance in comparison of specimens, and to Mr. H. T. Pagden for his interest and kindness in collecting and sending to me Mutillid specimens from the Solomon Islands.

Family **Mutillidæ**.

Genus SQUAMULOTILLA Bischoff.

Squamulotilla calliopeia Mickel.

♂, Lundu, Sarawak, January 6, 1914 (*G. E. Bryant*).

Squamulotilla clypealis Mickel.

♂, Sarawak, November 28, 1913 (*G. E. Bryant*).

* Paper No. 1452 of the 'Scientific Journal Series of the Minnesota Agricultural Experiment Station.'

Squamulotilla venatrix Mickel.

2 ♀♀, Mt. Matang, W. Sarawak, December 6, 1913, and January 30, 1914 (*G. E. Bryant*).

Genus Odontomutilla Ashmead.

Odontomutilla familiaris familiaris (Smith).

♀, Lundu, Sarawak, January 5–9, 1914 (*G. E. Bryant*); ♀, Mt. Merinjak, Sarawak, May 26, 1914 (*G. E. Bryant*); ♀, Puak, Sarawak, 1500 ft., May 6, 1914 (*G. E. Bryant*); ♀, Quop, W. Sarawak, March 2, 1914 (*G. E. Bryant*); ♂, Mt. Matang, Sarawak, December 27, 1913, 2000 ft. (*G. E. Bryant*); ♀ and 2 ♂♂, Kapah river, tributary of Tinjar river, Sarawak, October 5, 6, & 7, 1932 (*B. M. Hobby* and *A. W. Moore*); ♂, Mt. Dulit, Koyan river, Sarawak, November 21, 1932, 2500 ft., primary forest (*B. M. Hobby* and *A. W. Moore*).

Odontomutilla thymele Mickel.

♀, Puak, Sarawak, May 2, 1914 (*G. E. Bryant*).

Genus Timulla Ashmead.

Subgenus Trogaspidia Ashmead.

Timulla (Trogaspidia) cydippe Mickel.

7 ♂♂, Mt. Matang, W. Sarawak, November 2, 1913, December 2, 5, 6, & 20, 1913, January 29, 1914, and February 25, 1914 (*G. E. Bryant*).

Timulla (Trogaspidia) erato Mickel.

2 ♂♂, Mt. Matang, W. Sarawak, December 18, 1913, and January 21, 1914, 2000 ft. (*G. E. Bryant*); ♂, Lundu, Sarawak, January 5–9, 1914 (*G. E. Bryant*); ♂, Mt. Dulit, Sarawak, Dulit trail, October 6, 1932, primitive forest (*B. M. Hobby* and *A. W. Moore*).

Timulla (Trogaspidia) suspiciosa suspiciosa (Smith).

♂, Kapah river, tributary of Tinjar river, Sarawak, October 9, 1932 (*B. M. Hobby* and *A. W. Moore*); ♂, Mt. Dulit, Sarawak, October 17, 1932 (*B. M. Hobby* and *A. W. Moore*); ♂, Mt. Dulit, Sarawak, October 17, 1932, 4000 ft., moss forest (*B. M. Hobby* and *A. W. Moore*).

2

FIFTY YEARS IN OUR STUDY OF PROTECTIVE RESEMBLANCES AS EXEMPLIFIED IN THE ORDER INSECTA.

By Sir Edward B. Poulton, D.Sc., M.A., F.R.S., Hon. Life Pres. R.E.S.L., F.R.E.S., F.L.S., &c.

In attempting to bring forward a brief account of work and discussion upon Protective Resemblance, Warning Colours, and Mimicry, both Batesian and Müllerian, during the past half century, it is, I think, well to devote a brief section to their earlier history.

One of the most significant of the early statements upon Protective Resemblance was that made by A. R. Wallace in his section of the joint essay on Natural Selection read before the Linnean Society on July 1st, 1858:—"Even the peculiar colours of many animals, more especially of insects, so closely resembling the soil or leaves or bark on which they habitually reside, are explained on the same principle; for though in the course of ages varieties of many tints may have occurred, *yet those races having colours best adapted to concealment from their enemies would inevitably survive the longest.*" Much earlier than this W. J. Burchell wrote of "the intention of Nature" in giving to the Chameleon its power of changing colour, and to a pebble-like Acridian and Mesembryanthemum a resemblance protecting them from their natural enemies (1). He also wrote of plants "in this arid country, where every juicy vegetable would soon be eaten up," being given "an acrid or poisonous juice, or sharp thorns, to preserve the species from annihilation" (2). Both Protective and Aggressive Resemblances were also

Timulla (Trogaspidia) sibylla (Smith).

♀, Quop, W. Sarawak, February 26, 1914 (*G. E. Bryant*).

Timulla (Trogaspidia) shelfordi Mickel.

♂, Mt. Kalulong, Sarawak, November 1, 1932, 400–650 ft., primitive forest, on boulders in torrent (*B. M. Hobby* and *A. W. Moore*).

Timulla (Trogaspidia) scapus, sp. n.

♂.—Black, except first tergite posterior to the anterior margin, second and third segments entirely, and anterior half of fourth tergite, all ferruginous; clothed more or less with pale pubescence except the mesonotum, anterior half of scutellum and last two abdominal segments clothed with black pubescence; median area of clypeus glabrous, with a median longitudinal ridge, the posterior half of the ridge obsolete, the anterior half elevated into a conspicuous median glabrous subhemispherical elevation; distal half of scape conspicuously dilated and flattened, strongly bicarinate beneath, the parallel carinæ close together, each carina forming the margin of the ventral aspect of the scape, the ventral aspect thus narrow and sulcate; lateral ridges of hypopygium not widely separated. Length, 17 mm.

Head entirely black, clothed with sparse erect pale glittering pubescence, except the anterior half of front and lateral areas of clypeus with thick appressed pale glittering pubescence as well, and the ocellar area with a few erect fuscous hairs; mandibles moderately robust, deeply excised beneath near the base forming a prominent tooth, edentate at the apex and with a distinct tooth within the apex; clypeus as described above; distal half of scape strongly dilated and flattened as described above; first segment of flagellum slightly longer than the second; front with moderately large, more or less confluent punctures; vertex with moderate separated punctures, closer towards the hind margin of the head than behind the ocelli; genæ with moderate dense punctures; relative width of head and thorax at the tegulæ, 6·1 : 6·9.

Thorax entirely black, clothed with pale glittering pubescence, except the mesonotum and anterior half

of scutellum with sparse black pubescence, the pale pubescence dense on the median areas of the mesopleuræ, sparse elsewhere; pronotum with coarse confluent punctures; mesonotum with large, deep, mostly distinct, close punctures; parapsidal furrows distinct and deep on posterior half of mesonotum; mesonotum with a narrow median longitudinal glabrous impunctate line, the latter broadened at the anterior margin; scutellum strongly gibbose, with large dense punctures and the dorsal surface with a broad median longitudinal glabrous impunctate line; dorsum and posterior face of propodeum broadly reticulate, separated medially by a transverse crenulate ridge; enclosed space of dorsum of propodeum elongate slightly elevated posteriorly into a small tubercle; anterior third of enclosed space broad, the posterior two-thirds narrow and with the sides parallel; propleuræ longitudinally rugose, the anterior margin defined by a carina; ventral and dorsal areas of mesopleuræ elevated, the two areas separated by a furrow and both with large dense confluent punctures; anterior and posterior areas of mesopleuræ micropunctate; metapleuræ micropunctate except for a few shallow punctures ventrally; sides of propodeum micropunctate, except the posterior third broadly and shallowly reticulate; tegulæ large, glabrous, impunctate except the anterior and inner margins punctate and black pubescent.

Abdomen black, except the first tergite posterior to the anterior margin, the second and third segments entirely and the anterior half of the fourth tergite all ferruginous, clothed with sparse pale pubescence, except the segment posterior to the fifth clothed with sparse black pubescence; first tergite with large sparse punctures except the posterior margin with small distinct close punctures; disk of second tergite glabrous, almost impunctate, the lateral thirds of the tergite with moderate distinct punctures, and the posterior fifth slightly depressed and with small scattered punctures; tergites three to five with small sparse punctures; last tergite with a broad median tumescent glabrous area, rounded off posteriorly; lateral areas of last tergite with small close punctures; first sternite with a median longitudinal carina on the anterior two-thirds, the carina elevated posteriorly to form a small tooth, the carina

viewed in profile broadly shallowly emarginate; second sternite with large sparse shallow punctures, except the posterior margin with the punctures smaller; sternites three to six with moderately small punctures posteriorly; sternite seven very obscurely tuberculate at the postero-lateral angles, hypopygium with thick erect black pubescence medially and posteriorly, more or less obscuring the hypopygial ridges.

Wings fuscous, paler on the proximal third; cell 2nd R_1+R_2 squarely truncate at the apex; cell R_4 present, but not as well developed as R_5, receiving vein M_2 slightly beyond the middle; cell R_5 receiving vein M_{3+4} at three-fifths the distance from base to apex; vein *m-cu* terminating distinctly anterior to vein M_4+Cu_1.

Legs entirely black, clothed with sparse pale pubescence; calcaria pale.

Holotype.—♂, foot of Mt. Dulit, junction of rivers Tinjar and Lejok, Sarawak, Borneo, October 5, 1932 (at light trap) (*B. M. Hobby* and *A. W. Moore*), in British Museum (Natural History).

Paratypes.—2 ♂♂, River Kapah tributary of River Tinjar, Sarawak, Borneo, October 10, 1932, on door post of house (*B. M. Hobby* and *A. W. Moore*); ♂, River Kapah, tributary of River Tinjar, Sarawak, Borneo, October 7, 1932, in clearing (*B. M. Hobby* and *A. W. Moore*).

Very similar to *shelfordi* Mickel, the coloration being almost exactly the same except that *scapus* has more of the fourth abdominal tergite ferruginous; the median area of the clypeus is very similar in the two, in *scapus* the anterior elevation of the median area is evenly rounded throughout, while in *shelfordi* the elevation is abrupt anteriorly; the outstanding and conspicuous difference is in the character of the scape, it being normal for the genus in *shelfordi*, while in *scapus* the distal half of the scape is broadly expanded and flattened so that the ventral carinæ form the margins of a narrow, ventral face. The pronotum and mesonotum are more coarsely sculptured in *scapus* than in *shelfordi*. The genitalia of the two species have been examined and are conspicuously different. The relationship of the two species interpreted on the basis of genitalia is more distant than if interpreted on external characters alone.

Timulla (Trogaspidia) bryanti, sp. n.

♀.—Head, abdomen, and legs black, except the antennal tubercles ferruginous, the thorax entirely ferruginous; second abdominal tergite with a pair of anterior circular pale pubescent spots, the distance between them equal to their diameter; third and fourth tergites with a broad band of dense appressed pale pubescence, that on the third narrowly interrupted medially with black, that on the fourth broadly interrupted medially with black; pygidial area longitudinally striated on anterior two-thirds, unsculptured on posterior third. Length 9·5 mm.

Head entirely black, except antennal tubercles ferruginous, clothed with sparse short pale glittering pubescence, except the front and vertex with sparse black pubescence; mandibles edentate at the tip and with a small tooth within remote from the tip; antennal scrobes strongly carinate above; front, vertex, and genæ with moderate dense confluent punctures; relative widths of head and thorax, 4·0–3·7 mm.

Thorax entirely ferruginous, clothed with sparse inconspicuous pale pubescence, except the dorsum with very sparse erect and suberect blackish pubescence; humeral angles angulate but not conspicuous; mesonotal area slightly narrower than the pronotal or propodeal areas; relative widths at humeral angles, at small tubercles on lateral margin of pronotum, at anterior spiracles, immediately in front of propodeal spiracles, and widest portion of propodeum, 3·4 : 3·7 : 3·4 : 3·2 : 3·6; dorsum of thorax with large dense confluent punctures, the latter becoming deeper and coarser on dorsum of propodeum and merging into the strongly longitudinally rugose posterior face of propodeum; scutellar scale present and distinct; lateral margins of posterior face of propodeum denticulate; pleural areas micropunctate and micropubescent, shining, the sides of propodeum with obscure moderate punctures posteriorly.

Abdomen entirely black, clothed with black pubescence except the second, third, and fourth tergites with pale appressed pubescence as described above, the posterior half of lateral margins of second tergite and distal margins of all the sternites with pale appressed pubescence, the

sternites with fringes of sparse long pale hairs, and the first tergite and lateral margins of pygidial tergite with long erect pale fuscous pubescence; second tergite with moderate separated punctures interspersed with fine close punctures, the moderate punctures visible through the pale appressed pubescence; pygidium as described above; first sternite with a median longitudinal carina on the anterior half, the carina slightly elevated into a tooth at its posterior terminus; second sternite with sparse moderate punctures, the latter becoming close at the posterior margin; sternites three to six with sparse small punctures, the latter becoming close at the posterior margin of each sternite.

Legs entirely black, clothed with sparse pale pubescence throughout; tibial spines ferruginous; calcaria pale.

Holotype.—♀, Mt. Matang, W. Sarawak, Borneo, December 1913 (*G. E. Bryant*), in British Museum (Natural History).

Paratypes.—♀, Mt. Matang, W. Sarawak, Borneo, December 1913 (*G. E. Bryant*); ♀, Mt. Matang, W. Sarawak, Borneo, December 1913–January 1914 (*G. E. Bryant*).

Apparently related to *repræsentans* Smith, but differs in having the pale spots of second tergite smaller than in *repræsentans*; in *bryanti* the distance between the spots equal to their diameter, in *repræsentans* the same distance equal to only four-fifths of their diameter; *bryanti* also differs from *repræsentans* in having the coxæ entirely black, and in the striæ of the pygidium being slightly sinuate rather than straight.

Timulla (Trogaspidia) saturnia samawangensis Mickel.

♂, Mt. Matang, Sarawak, December 21, 1913 (*G. E. Bryant*); ♂, Kapah river, tributary of Tinjar river, Sarawak, September 24, 1932, primitive forest (*B. M. Hobby* and *A. W. Moore*); ♂, Mt. Dulit, Sarawak, October 19, 1932, 4000 ft., moss forest (*B. M. Hobby* and *A. W. Moore*).

Timulla (Trogaspidia) hylonome Mickel.

♂, Mt. Matang, Sarawak, January 30, 1914 (*G. E. Bryant*).

Timulla (*Trogaspidia*) *nedyme* Mickel.

♂, Mt. Matang, Sarawak, December 10, 1913, 1000 ft. (*G. E. Bryant*).

Timulla (*Trogaspidia*) *olbia* Mickel.

4 ♂♂, Mt. Matang, Sarawak, December 4 & 6, 1913, 2000 ft., January 1914 and February 11, 1914, 1000 ft. (*G. E. Bryant*); ♂, Kapah river, tributary of Tinjar river, Sarawak, September 28, 1932 (*B. M. Hobby* and *A. W. Moore*); 4 ♂♂, Mt. Dulit, Sarawak, October 17, 18 & 19, 1932, 4000 ft., moss forest, and October 24, 1932, 3000 ft., moss forest (*B. M. Hobby* and *A. W. Moore*); ♂, Mt. Dulit, Koyan river, Sarawak, November 21, 1932, 2500 ft., primary forest (*B. M. Hobby* and *A. W. Moore*).

Timulla (*Trogaspidia*) *dercetis* Mickel.

2 ♂♂, foot of Mt. Dulit, junction of Tinjar and Lejok rivers, Sarawak, September 24, 1932, primitive forest, undergrowth, and October 11, 1932, wet mud (*B. M. Hobby* and *A. W. Moore*); ♂, Kapah river, tributary of Tinjar river, Sarawak, September 24, 1932, primitive forest, undergrowth (*B. M. Hobby* and *A. W. Moore*); ♂, Mt. Dulit, Sarawak, Dulit trail, October 6, 1932 (*B. M. Hobby* and *A. W. Moore*).

Timulla (*Trogaspidia*) *proserpina proserpina* (Smith).

Mutilla proserpina Smith, 1858, J. Proc. Linn. Soc., Zool. ii. p. 85, ♀.
Timulla (*Trogaspidia*) *proserpina proserpina* Mickel, 1935, Trans. Roy. Ent. Soc. London, lxxxiii. p. 269, ♀.
Timulla (*Trogaspidia*) *fortuita nebulosa* Mickel, 1935, Trans. Roy. Ent. Soc. London, lxxxiii. p. 263, ♂. (New synonymy.)

The above synonymy results from the examination of a male and female specimen taken *in copula* by G. E. Bryant at Quop, Sarawak, February 14, 1914.

♂, Mt. Merinjak, Sarawak, 1500 ft. (*G. E. Bryant*); ♀, Quop, W. Sarawak, March 1914 (*G. E. Bryant*); ♀, Puak, Sarawak, May 1, 1914 (*G. E. Bryant*); ♂, Mt. Kalulong, Sarawak, November 19, 1932, 2500 to 3000 ft., on wet undergrowth, primitive forest (*B. M. Hobby* and *A. W. Moore*); 7 ♂♂, Mt. Dulit, Sarawak, October 16, 18, 19, 22, 26, & 28, 4000 ft., moss forest (*B. M. Hobby* and *A. W. Moore*); 2 ♂♂, Mt. Dulit, Koyan river, Sarawak, October 19, 1932 and November 18, 1932, 2500 ft., primary forest (*B. M. Hobby* and *A. W. Moore*); 2 ♂♂,

Mt. Dulit, Sarawak, October 26, 1932, 4000 ft., moss forest, light trap (*B. M. Hobby* and *A. W. Moore*); ♂, foot of Mt. Dulit, junction of Tinjar and Lejok rivers, Sarawak, October 8, 1932, light trap (*B. M. Hobby* and *A. W. Moore*).

Timulla (Trogaspidia) proserpina tibiata Mickel.

Timulla (Trogaspidia) proserpina tibiata Mickel, 1934, Philipp. J. Sci. liv. (1) p. 176, ♀.
Timulla (Trogaspidia) fortuita Mickel, 1934, Philipp. J. Sci. liv. (1) p. 181, ♂. (New synonymy.)
Timulla (Trogaspidia) fortuita fortuita Mickel, 1935, Trans. Roy. Ent. Soc. London, lxxxiii. p. 263, ♂. (New synonymy.)

The specimens mentioned just preceding as having been taken *in copula* at Quop, Sarawak, Borneo, demonstrated that *T.* (*T.*) *fortuita nebulosa* was the male sex of *T.* (*T.*) *proserpina proserpina* Smith. Both of these are represented by subspecies in the Philippine Islands. It is, therefore, logical to conclude that *T.* (*T.*) *proserpina tibiata*, ♀, and *T.* (*T.*) *fortuita fortuita*, ♂, which was recorded from somewhat the same geographical area in the Philippine Islands, are the two sexes of the same species, resulting in the above synonymy. *T.* (*T.*) *proserpina sibuyanensis* is excluded from consideration because the differences between *proserpina proserpina*, and the former are greater than those between *proserpina proserpina* and *proserpina tibiata*, and because the known distribution of *sibuyanensis* is limited to a single island.

Timulla (Trogaspidia) bagrada (Cameron).

9 ♂♂, Lundu, Sarawak, January 5–9, 6, & 7 (*G. E. Bryant*); ♂, Mt. Merinjak, Sarawak, May 26, 1914, 1500 ft. (*G. E. Bryant*).

Timulla (Trogaspidia) depressicornis Mickel.

♂, Mt. Matang, Sarawak, December 10, 1913, 1000 ft. (*G. E. Bryant*); ♂, Mt. Merinjak, Sarawak, May 1914 (*G. E. Bryant*); 2 ♂♂, Mt. Dulit, Koyan river, Sarawak, November 18 & 21, 1932, 2500 ft., primary forest (*B. M. Hobby* and *A. W. Moore*).

Timulla (Trogaspidia) ira ira (Cameron).

3 ♂♂, Kapah river, tributary of Tinjar river, Sarawak, September 25, 1932, and November 8, 1932, old secondary forest (*B. M. Hobby* and *A. W. Moore*); 4 ♂♂, foot of

Mt. Dulit, junction of Tinjar and Lejok rivers, August 22, 1932, cultivated land now waste, September 11 & 23, 1932, old secondary forest, and September 24, 1932, undergrowth, primitive forest (*B. M. Hobby* and *A. W. Moore*); ♂, Mt. Kalulong, Tebani river, November 31, 1932, on freshly felled young trees, undergrowth, primitive forest (*B. M. Hobby* and *A. W. Moore*); ♂, Sarawak (*B. M. Hobby* and *A. W. Moore*).

Timulla (*Trogaspidia*) *mamblia* (Cameron).

♀, Quop, W. Sarawak, March 2, 1914 (*G. E. Bryant*).

Timulla (*Trogaspidia*) *psecas* Mickel.

8 ♀♀, Mt. Matang, W. Sarawak, December 1913, December 6, 1913, January 1914, January 23, 1914, and February 9 & 14, 1914, 1000 ft. (*G. E. Bryant*); 3 ♀♀, Mt. Merinjak, Sarawak, May 22 & 24, 1914, 600 ft. (*G. E Bryant*); ♀, Quop, W. Sarawak, March 11, 1914 (*G. E. Bryant*); 2 ♀♀, Mt. Dulit, Sarawak, October 19, 1932, 4000 ft., moss forest (*B. M. Hobby* and *A. W. Moore*).

Genus Smicromyrme Thomson.

Smicromyrme runcina (Zavattari).

2 ♂♂, Mt. Matang, Sarawak, December 11, 1913, 2000 ft., and May 14, 1914, 600 ft. (*G. E. Bryant*); ♂, Mt. Dulit, Koyan river, Sarawak, November 17, 1932, 2500 ft., primary forest (*B. M. Hobby* and *A. W. Moore*).

Smicromyrme zavattarii Mickel.

♂, Mt. Matang, Sarawak, December 20, 1913 (*G. E. Bryant*).

Smicromyrme delia Mickel.

♀, Mt. Merinjak, Sarawak, May 24, 1914, 600 ft. (*G. E.* Bryant).

Smicromyrme meator Mickel.

♂, Kapah river, tributary of Tinjar river, Sarawak, September 25, 1932 (*B. M. Hobby* and *A. W. Moore*).

Smicromyrme punctinota Mickel.

♂, Mt. Matang, Sarawak, January 18, 1914 (*G. E. Bryant*).

Smicromyrme petina, sp. n.

♀.—Head and abdomen black, the thorax, legs, mandibles except the tips, antennal tubercles, scape, pedicel, first segment of flagellum, remainder of flagellum beneath, and first sternite, all ferruginous; second tergite with a median longitudinal groove anteriorly; second tergite with a median anterior elongate ovate spot in the median groove, and a narrow band at the posterior margin of dense appressed pale pubescence; third tergite with a broad band of dense appressed pale pubescence; front and vertex with an inconspicuous low median longitudinal carina; scutellar scale present and distinct; pygidial area not defined laterally by a carina, glabrous, unsculptured. Length 6·5 mm.

Head black, with above exceptions, the clypeus and genæ with pale pubescence, the front and vertex with sparse black pubescence; front, vertex, and genæ with moderate dense confluent punctures; antennal scrobes feebly carinate above; relative widths of head and thorax, 3·0 : 2·2.

Thorax entirely ferruginous, the dorsum with sparse dark pubescence, the posterior face of propodeum with sparse long erect pale pubescence, and the pleural areas with sparse short pale pubescence; thorax not narrower posteriorly than anteriorly; dorsum of thorax with large dense confluent punctures merging into the deeply reticulate dorsum of propodeum, the reticulate area extending on to the posterior face of propodeum and the latter becoming longitudinally rugose posteriorly; humeral angles angulate, but not prominent; lateral margins of dorsum of thorax crenulate, subparallel; lateral margins of posterior face of propodeum denticulate; pleural areas glabrous, micropunctate; scutellar scale present.

Abdomen black, except first sternite ferruginous, with pubescent markings as described above; second tergite with a median anterior longitudinal groove, and with large dense deep punctures, the latter becoming distinct and separated laterally, and the posterior margin of the tergite with fine punctures beneath the pale pubescence; pygidial area glabrous, unsculptured, not separated laterally from the punctate areas by a carina; first sternite with a median longitudinal carina; second

sternite with moderate distinct punctures; all the sternites with sparse pale pubescence.

Legs ferruginous, the tibiæ and tarsi somewhat darker than the rest; calcaria pale.

Holotype.—♀, Mt. Matang, W. Sarawak, Borneo, February 12, 1914 (*G. E. Bryant*), in British Museum (Natural History).

Paratype.—♀, Mt. Matang, W. Sarawak, Borneo, December 1913 (*G. E. Bryant*).

Runs to *decora* Smith in the key to *Smicromyrme* (Mickel, 1935). The following couplet will separate the two:—

Thorax distinctly narrower posteriorly than anteriorly; second abdominal tergite without a median longitudinal groove anteriorly; first abdominal segment ferruginous, remainder of abdomen black, appearing purple in certain lights; second tergite with small close distinct punctures.	*decora* (Smith).
Thorax not narrower posteriorly than anteriorly; second tergite with a distinct median longitudinal groove anteriorly and with large, dense, deep punctures; abdomen entirely black	*petina*, sp. n.

Smicromyrme lochia, sp. n.

♀.—Head and abdomen black; thorax entirely ferruginous; coxæ, trochanters, and femora ferruginous like the thorax, the tibiæ and tarsi dark ferruginous, somewhat blackish; second tergite with an elongate anterior median spot and a narrow band at the posterior margin of dense appressed pale pubescence; third tergite with a broad band of dense appressed pale pubescence; scutellar scale entirely absent; pygidial area defined laterally by a carina, obscurely finely longitudinally rugose on anterior half, otherwise glabrous. Length 6 mm.

Head black, the mandibles except the tips, antennal tubercles, scape, and pedicel all ferruginous; clypeus and genæ clothed with appressed pale pubescence; front and vertex with sparse erect black pubescence; antennal scrobes carinate above; front, vertex, and genæ with moderate dense confluent punctures; relative widths of head and thorax, 2·6–2·2.

Thorax entirely ferruginous, the dorsum clothed with sparse, erect, dark ferruginous pubescence, the posterior

recognised by Erasmus Darwin who wrote:—" The colours of many animals seem adapted to their purposes of concealing themselves either to avoid danger, or to spring upon their prey " (3). The Variable Protective Resemblance ot the Octopus was observed by Charles Darwin in the Cape de Verde Islands in 1832. Writing a little later to Henslow, he referred to its " most marvellous power of changing its colours, equalling any chameleon, and evidently accommodating the changes to the colour of the ground which it passed over " (4). Wallace first suggested the meaning of the conspicuous Warning Colours of insects in reply to a letter from Darwin who was puzzled by the brilliant appearance of many caterpillars which could not be explained by Sexual Selection. The interpretation offered—an advertisement of distastefulness—received confirmation from the experiments of Jenner Weir and A. G. Butler (5), and has been the subject of investigation and discussion up to the present day. The superficial resemblances between insects of different groups were known long before the publication of Bates' classical memoir on Mimicry, the best examples known to me being those recorded by W. J. Burchell in his manuscript notebooks and on labels in his collections made in S. Africa (1810-15) and Brazil (1825-30).

H. W. Bates' paper explaining the resemblances between the butterflies of the Amazons was published in *The Transactions of the Linnean Society* for 1862, four years after the Darwin-Wallace Essay on Natural Selection was read in 1858. It was followed in the Linnean Transactions of 1865 by Wallace's description of analogous resemblances between Malayan butterflies, and in 1868 by Roland Trimen on those between the butterflies of S. Africa. Ten years later Fritz Müller first brought forward his hypothesis, explaining a large proportion of the examples of Mimicry as produced by the advantageous resemblance between distasteful species rather than by the resemblance of a palatable mimic to its distasteful model (6).

The year before the Jubilee period the earlier experimental work on the protective value of insect colours was brought together by the present writer (7). Much help was given by Jenner Weir and Raphael Meldola, whose name must always be remembered in the history of evolutionary thought during the early years of the period and for many before it. His work as Darwin's " general agent " in Entomology is briefly described in this journal (8). The immensely important discovery of protective counter-shading, explaining the meaning of the white undersides of animals was first published in 1895 by Abbott H. Thayer in the April and October issues of " The Auk," the American journal of Ornithology, and a condensed account of the two articles appeared in " Nature " (1902). The author communicated a paper on the subject to the *Ent. Soc. Lond.* in 1903 (p. 553), discussed by the present writer on p. 570. The subject was expanded and finely illustrated in " Concealing Coloration in the Animal Kingdom," 1909, by his son, Gerald H. Thayer, with a second edition in 1918 (9). The number of publications on the concealing (Procryptic) adaptations of insects is so large that, in this brief article, I feel that I must not do more than refer to W. A. Lamborn's discovery of the method by which the larva of an African Tabanid fly prevents the wide cracks formed in the dry season from invading the clay cylinder in which the pupa lies hidden, and thus exposing it to attack (10). In a paper (11) read before the Lin-

face of propodeum with sparse long erect pale fuscous pubescence, and the pleural areas with very sparse pale pubescence; mesonotal area not noticeably constricted, the lateral margins of the dorsum crenulate and subparallel; dorsum with dense deep confluent punctures merging into the reticulate dorsum of propodeum, the reticulate area extending on to the anterior part of the posterior face of propodeum; humeral angles angulate but not prominent; scutellar scale entirely absent; pleural areas glabrous, micropunctate.

Abdomen black, except the first sternite ferruginous; abdominal pubescent markings as above; second tergite with a shallow median longitudinal groove anteriorly; anterior pale pubescent spot in the median groove; second tergite with moderate dense punctures except laterally, the punctures separated, and the distal margin glabrous and finely punctate; tergites three to five finely punctate; pygidial area as described above; first sternite with a distinct median longitudinal carina; second sternite with moderate distinct separated punctures; pubescence of all the sternites pale.

Legs ferruginous like the thorax, except the tibiæ and tarsi very dark blackish; calcaria pale.

Holotype.—♀, Mt. Matang, Sarawak, Borneo, December, 1913 (*G. E. Bryant*), in British Museum (Natural History).

Paratype.—♀, Penang, Federated Malay States, October 1913 (*G. E. Bryant*).

Very similar to *parva* Brown, the colour and the pubescent markings being the same, except in *parva* the antennal tubercles are black and the first tergite is tinged with ferruginous. Differs from *parva* in having the lateral margins of the dorsum of the thorax crenulate, in the coarser puncturation, and the anterior median longitudinal groove of the second tergite.

It is doubtful whether or not the locality labels on the holotype and paratype are correct. My opinion is that the locality label of the holotype is probably correct and that of the paratype incorrect. It seems to me unlikely that this species occurs in both localities. Additional lots of material from both localities are necessary before the geographical distribution of the species can be definitely settled.

Smicromyrme basalis basalis (Smith).

2 ♀♀, Mt. Matang, Sarawak, December 1913 and January 1914 (*G. E. Bryant*).

Genus Ephutomorpha André.

Ephutomorpha tulagiensis, sp. n.

♀.—Black, except proximal two-thirds of mandibles, clypeus entirely, proximal half of flagellum beneath, coxæ, trochanters, proximal half of femora, proximal half of tibiæ, and tarsi entirely, all testaceous, and a large elongate subrectangular spot on dorsum of thorax, as well as a small transverse median spot on second tergite both ferruginous; vertex and mesonotum each with a pair of small spots of pale glittering pubescence; distal margin of first tergite and distal margin of second tergite each with a pair of pale spots, the colour integumental and pubescent; fifth tergite with a median spot of pale pubescence; proximal half of pygidium longitudinally striate, the distal half granulate. Length 5·5 mm.

Head black, except the proximal two-thirds of mandibles, clypeus entirely, and proximal half of flagellum beneath testaceous; clothed with sparse fuscous to black pubescence except the vertex, with a pair of spots of pale glittering pubescence contiguous with the eyes, the anterior margin of front with a few pale hairs and the scape pale pubescent; mandibles edentate, without a tooth within, the distal third black; antennal tubercles distinctly separated; first segment of flagellum about one and one-half times longer than the second; antennal scrobes not carinate above; front, vertex, and genæ with small dense more or less confluent punctures; relative widths of head and thorax, 2·5 : 2·3.

Thorax hexagonal in outline, black, except the dorsum with a large elongate subrectangular ferruginous spot, the latter extending from the anterior margin of the mesonotum to the posterior margin of dorsum of propodeum and its anterior margin angulate medially; mesonotum with a pair of obscure spots of pale glittering pubescence situated at the lateral margins of the ferruginous spot; dorsum of propodeum elsewhere with black pubescence and with small dense punctures throughout; scutellar scale absent; posterior face of propodeum with

small distinct separated punctures and clothed with sparse erect pale hairs; propleuræ finely punctured; anterior area of mesopleuræ glabrous, the ventro-dorsal ridge densely punctate and the posterior area glabrous, impunctate; metapleuræ and sides of propodeum glabrous, impunctate.

Abdomen black, except posterior third of second sternite, and third and fourth sternites more or less testaceous, the distal margin of first and second tergites each with a pair of pale spots, the colour both integumental and pubescent, and the second tergite also with a median transverse ferruginous spot; anterior face of first tergite with sparse small punctures, the dorsal face densely punctate; pale spots at distal margin separated by about their own diameter; second tergite with small dense punctures throughout, the pale spots at the distal margin almost as high as broad and separated by about one and one-half times their own transverse diameter; tergites three to five with fine dense punctures, all the tergites clothed with sparse black pubescence except as noted, the lateral margins of each with obscure sparse pale hairs, and the fifth tergite with a median spot of pale pubescence; pygidium as noted above; first sternite with a median longitudinal carina on the anterior half; second sternite with distinct, more or less contiguous, punctures; sternites three to five with small close punctures at the distal margin; last sternite with small close punctures; all the sternites with sparse pale pubescence.

Legs testaceous except the distal half of the femora and distal half of tibiæ black; tibiæ with a single row of spines; calcaria pale testaceous.

Holotype.—♀, Tulagi, British Solomon Islands, December 25, 1934, Sasapi cutting (*H. T. Pagden*), in University of Minnesota collection.

Paratypes.—2 ♀♀, Tulagi, British Solomon Islands, December 25, 1934, Saspai cutting (*H. T. Pagden*).

Related to *pagdeni* Mickel, but differs in the glabrous impunctate posterior area of mesopleuræ and metapleuræ, the granulate distal half of pygidium, testaceous clypeus, ferruginous spots on dorsum of thorax and second tergite, and smaller pale spots at distal margin of second tergite.

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44

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Article III.—RESULTS OF THE OXFORD UNIVERSITY SARAWAK (BORNEO) EXPEDITION: BORNEAN STINGLESS BEES OF THE GENUS *TRIGONA*

BY HERBERT F. SCHWARZ

PLATES II TO VII

The present paper is primarily a report of the Meliponidae collected in 1932 by the Oxford University Sarawak (Borneo) Expedition, in which Dr. B. M. Hobby and A. W. Moore participated as entomologists. In making the determinations I have had opportunity to study the types of certain of the Indo-Malayan species deposited by Professor Cockerell at the U. S. National Museum, the types of *Trigona* from that region described by Smith, Cameron, and Cockerell that are in the British Museum as well as the Smith types in the Wilson Saunders collection at the Oxford University Museum. With characteristic generosity Professor Cockerell, upon learning that I planned to study the *Trigona* types at the British Museum, undertook to aid my investigation by depositing there all of the types of Indo-Malayan *Trigona* that had not hitherto been distributed from his private collection. For his cordial coöperation as evidenced by this action and throughout his personal correspondence with me regarding the group to be studied I desire to record my hearty thanks. I am deeply appreciative, too, of the courtesies extended to me by Miss Grace Sandhouse and by Mr. Robert Benson, respectively in charge of Hymenoptera at the U. S. National Museum and at the British Museum, during my visits to those institutions, and for equally helpful coöperation received at the Oxford University Museum. In The American Museum of Natural History are paratypes of several of the Indo-Malayan species described by Professor Friese and these, too, have been studied in connection with the collection of Messrs. Hobby and Moore.

I have been especially fortunate in having the coöperation as artist of Mr. Pierre-Noël whose accurate drawings, to scale, should prove of distinct aid in visualizing the characters of the several species considered. To Miss Ethel Olsen, secretary of the department of entomology of the American Museum, I am indebted for having transcribed with faultless accuracy and good judgment my much interlineated longhand manuscript.

A total of sixteen different forms are represented in the catch of the Oxford University Expedition, and of these four are believed to be new. From 1857, when Frederick Smith described *ventralis*, *apicalis*, and *canifrons* the first *Trigona* to be reported from Borneo—to 1933, when Friese erected his *sericea* and *borneënsis*, a total of thirty-two species have been recorded from the island (see list at end of this paper). Several of these are to be regarded as synonyms while others represent merely phases of variability within a species. It may, therefore, be conservatively stated that the collection of the Oxford University Expedition includes about one-half of the species hitherto reported from Borneo, in addition to certain new forms. This total is the more impressive when it is stated that the specimens, with a minimum of exception, were collected between the foot of Mt. Dulit and an elevation of 4000 feet on that mountain.

In his recent study of 'The Distribution of Mammals and Birds in Sarawak and Adjacent Parts of Borneo' (1933, Proc. of Zool. Soc. of London, I, pp. 273-282, Pl. 1), E. Banks offers, among others, the following conclusions:—

The fauna of Bornean mountains over 3000 feet high differs from that of the lowlands and hills up to that height.

The highland fauna is most numerous on Mt. Kinabalu, less so on Mts. Murud and Dulit, further reduced on Mts. Penrissen and Poi.

. . . .

The highland fauna is composed of two elements, with and without lowland racial or specific representatives.

The latter element is in a majority more marked on Mt. Kinabalu, on Murud, and Dulit than on Mts. Penrissen and Poi.

Unfortunately there are no specimens of *Trigona* available from the mountains mentioned other than Dulit, so that it is impossible to say to what extent generalizations applicable to the mammals and the birds may be applied also to the stingless bees. But it may perhaps not be amiss in this connection to list the species taken at different elevations on Mt. Dulit.

I.—Lowland Slopes

A.—Foot of Mt. Dulit

Trigona confusella
Trigona haematoptera variety *dulitae*, new variety
Trigona melanocephala
Trigona terminata variety *latebalteata*

Trigona iridipennis
Trigona itama
Trigona thoracica variety *lacteifasciata*
Trigona ventralis

B.—Mt. Dulit, R. Lejok

Trigona iridipennis
Trigona melanocephala
Trigona melina
Trigona moorei, new species
Trigona ventralis

C.—Mt. Dulit Trail

Trigona fimbriata
Trigona iridipennis
Trigona melanocephala
Trigona melina

II. Mt. Dulit, at an Elevation of 2500 Feet

Trigona apicalis
Trigona collina
Trigona melina

III Mt. Dulit, at an Elevation of 4000 Feet Moss Forest

Trigona collina
Trigona hobbyi, new species
Trigona melanocephala
Trigona rufibasalis
Trigona sarawakensis, new species

IV—R. Kapah, Tributary of R. Tinjar

Trigona fimbriata
Trigona itama
Trigona melanocephala

V.—Mt. Kalulong, at an Elevation of 1800 Feet

Trigona haematoptera variety *dulitae*, new variety

Eleven forms were collected either at the foot of Mt. Dulit, on the Mt. Dulit Trail, on R. Lejok, or R. Kapah, which represent elevations less than 2000 ft. Of these one (*melina*) was duplicated at 2500 feet, and another (*melanocephala*), rather well represented on the lower slopes, was again secured further upward at 4000 feet. One species (*collina*), secured at 2500 ft., was taken again at 4000 feet. Of the three specimens obtained at 4000 feet that are not duplicated in the catch at lower elevations, two (*hobbyi* and *sarawakensis*) are here recognized as new species. One of the bees, *haematoptera* variety *dulitae*, new variety, obtained in numbers at the foot of Mt. Dulit, is repre-

sented by a single specimen collected at an elevation of 1800 feet on Mt. Kalulong.

The collection made on Mt. Dulit is evidence of the large number of forms obtainable in a relatively small area, especially when such an area presents different levels of altitude. From the Indo-Malayan region in excess of seventy forms have been described or reported, but allowance must be made for the fact that some of these are synonyms or not very clearly separable varieties.[1] The sixteen forms collected in the environment of Mt. Dulit thus may be said roughly to represent one-quarter of the known Meliponid fauna of the Indo-Malayan region. If this proportion seems extraordinarily high, it is to be remembered that similarly limited areas in the New World that have been intensively scoured for specimens have been found to harbor a substantial fraction of the total recorded fauna of a vastly larger embracing area Thus the successive expeditions to Barro Colorado Island in the Canal Zone have resulted in assembling twenty-six species and subspecies from that speck of land—only about three miles in diameter. This is more than one-third of the known forms of stingless bees (somewhat under seventy in number) listed by Lutz and Cockerell (1920, Bull. Amer. Museum Nat. Hist., XLII, pp. 492-502) from all Central America and Mexico.

It is pertinent, too, to cite the experience of Alfred Russell Wallace at a collecting site "near the Simunjon River, a small branch of the Sádong, a river east of Saráwak and between it and the Batang-Lupar." Wallace states ('The Malay Archipelago,' second edition, 1869, Vol. I, p. 37) that "When I arrived at the mines, on the 14th of March, I had collected in the four preceding months, 320 different kinds of beetles. In less than a fortnight I had doubled this number, an average of about 24 new species every day. On one day I collected 76 different kinds, of which 34 were new to me. By the end of April I had more than a thousand species, and they then went on increasing at a slower rate; so that I obtained altogether in Borneo about two thousand distinct kinds, of which all but about a hundred were collected at this place, and on scarcely more than a square mile of ground."

Several of the species here reported upon—*ventralis*, *terminata* variety

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[1] From Professor T D A Cockerell I have recieved the following statement, drawn up by H M Pendlebury, offering an explanation for the relatively greater abundance of stingless bees in Malaysia as compared with the areas beyond·

"I suppose that the reason why *Trigona* are so numerous in Siam, Malaya, and Borneo, and so poor outside these limits is possibly due to the greater number of resin-secreting trees belonging to the Dipterocarpaceae found in Malaysia; the stable conditions regarding humidity and temperature may be contributory factors also"

latebalteata, fulvopilosella, and *trochanterica*—are relatives of such New World species as *lineata, opaca, prosopiformis, haeckeli, schrottkyi,* and *impunctata,* having like these the head and thorax dull and opaque due to a microscopic tessellation that is utterly devoid of shiny interspaces and also having the hairs fringing their hind tibiae posteriorly not branched but simple.

The greater number of the species here reported upon, however, belong to *Tetragona,* which I believe to be a valid subgenus of *Trigona.* An abdomen distinctly narrower than the thorax and rather elongate is a character usually associated with *Tetragona* because it applies to the type species, *clavipes,* but the mere possession of a narrow abdomen would admit into the fold of *Tetragona* such an insect as *compressa,* which has a four-toothed mandible and is in my judgment assignable to *Trigona* subgenus *Trigona.* In my estimation the width of the abdomen is not of determining importance for the admission to or exclusion from *Tetragona* of any given Meliponid. Subgenus *Trigona* and subgenus *Tetragona* are, it seems to me, very closely related. Both are characterized by plumose hairs on the posterior fringe of the hind tibiae, usually supplemented by similar hairs on the outer surface of the middle tibiae and on the outer surface of the hind tibiae basally. In the possession of this posterior fringe of plumose hairs these two subgenera, which, in addition, have the chitin smooth or at least devoid of decided sculpturing, differentiate themselves from other subdivisions of the genus *Trigona.* The worker of *Trigona* has the mandible completely toothed along the apex, being either quadridentate or, more often, quinquedentate. The subgenus *Tetragona,* on the other hand, has the outer half or two-thirds of the apex of the mandible edentate. The worker of all species of the subgenus *Trigona* has a well differentiated flat, bristleless although usually sericeous, oval area at the base of the inner surface of the hind metatarsi that contrasts with the metatarsal brush occupying the greater part of the joint. Such a differentiated area characterizes also the males, so far as known, of the several species and subspecies of the subgenus *Trigona.* Among the New World species of *Tetragona* only a few—*jaty, buchwaldi,* and *pfeifferi*—share with true *Trigona* this differentiated patch on the hind metatarsus. In the case of *jaty* it is the worker only that has this distinction. The males of *buchwaldi* and *pfeifferi* are unknown. On the other hand, a predominant number of the *Tetragona* from Borneo—and indeed from the Indo-Malayan region generally—are characterized in the worker, at least, by this earmark of relationship (Pl. IV, fig. M[1]).

Another character which has been frequently emphasized in the key is the emphatic development of the two inner teeth of the mandible in a great many of the species (see especially Pl. II, figs. A, B, C, D). Even the first of these two teeth is impressive in size due to a deep and decided cleft between it and the edentate outer one-half to two-thirds of the mandible, but the second and innermost tooth is even more developed and springs from a point on the inner contour almost midway toward the base of the mandible. Among the New World *Tetragona* the species and subspecies of *heideri* share this peculiar dentition. *Trigona heideri* is cited as being particularly combative. Ducke (1925, Zool. Jahr. Syst. Geogr. u. Biol., XLIX, p. 383) called it by far the most aggressive species of those with whose nests he was familiar and added in a footnote that it will attack even though the victim be many meters distant from the nest and even though he has in no wise molested the insects. Dr. Roman (cited by Alfken, 1930, Arkiv för Zoologi, XXI A, No. 28, p. 8) found *heideri* very inclined to bite. The unusually strong teeth on the inner side of the mandible of *heideri* seem a particularly potent weapon to be associated with so aggressive a bee, and one might assume offhand that there is a similar manifestation of aggressiveness on the part of the Bornean bees of comparable armature. Dr. Hobby tells me, however, that he did not experience any unusual molestation even though one of the forms with developed teeth (*haematoptera* variety *dulitae*) was in part collected from a nest.

As the key supplied for the present paper indicates, several of the species are characterized by a sharp color contrast between the dark basal half of the wing and the milky apical half with its bright orange-colored stigma and venation (Pl. VII, fig. Z). Although there are wing patterns in several of the New World *Trigona*, only *dimidiata* Smith among the described Neotropical Meliponidae duplicates the condition that is common to so many Indo-Malayan stingless bees, and *dimidiata* is a member not of the subgenus *Tetragona* but of the subgenus *Trigona*.

In the following key are included all of the forms collected by the Oxford University Sarawak (Borneo) Expedition as well as such other species from Borneo as are known to me from an examination of the type material or which on other grounds I believe can be interpreted with some confidence that the interpretation is correct. In certain cases superficial characters have been relied upon for separation, especially where these superficial characters are pronounced and constant or where the plastic characters tend to be concealed. In the main, however, more reliance has been placed on structural char-

nean Society in 1898 I attempted to describe under different heads the chief general characteristics of Mimetic Resemblances, Batesian and Müllerian, and to show that the evolution of each one had required the operation of Natural Selection. After the lapse of 40 years I venture to quote a sentence from A. R. Wallace's letter written 28th December 1898, the day on which Roland Trimen also sent congratulations:—"It is the completest, and most conclusive article that has yet appeared, and to all who *will* read and *can* reason, it is absolutely unanswerable."

Probably the most important contribution to our subject in the Jubilee years and one which has been largely responsible for the dominant position of Africa as a field for Bionomic research in the present century, is the Memoir (12) by G. A. K. Marshall (now Sir Guy) on observations and experiments on insects during the period 1896-1901. An American friend, after reading it, wrote to me:—"It is the paper we have all been waiting for." In spite of its length, close on 300 pages, and the great variety of the subjects treated, the memoir is remarkably easy to consult being provided with an elaborate but very clear table of contents and a separate index. It is of course impossible to attempt any account of this admirable work, but I cannot help referring to the first three plates illustrating the injuries to be found upon the wings of butterflies, which, when the specimens are fresh and unworn, must nearly always have been inflicted by enemies, especially birds. This evidence, powerfully enforced by Marshall's later publication on "Birds as a factor in the Production of Mimetic Resemblance among Butterflies" (13), led on to very many observations recorded by Prof. Hale Carpenter, Collenette, Lamborn and others.

The late R. Shelford, while Curator of the Sarawak Museum, wrote on the "Mimetic Insects and Spiders from Borneo and Singapore" (14), a paper of especial importance because of the variety of insect families which are considered and illustrated by fine coloured plates. Ten years later he published "Mimicry amongst the Blattidae" (15), describing and figuring many "Mimetic Cockroaches and Beetle models"—striking examples in a family which had rarely if ever been studied from this point of view. A very interesting nesting association between birds and social insects—Aculeates and Termites—is described by J. G. Myers (16), who concludes (p. 19) that the wasps, bees and ants "are all among the most vicious species" and holds that "association of birds with aculeates and of the latter *inter se*, corresponds to some definite ecological need," and that "we are justified in assuming that this need is protection." The long list of references also proves that this association has been observed by many naturalists.

The experimental method of investigating the palatability of protectively coloured and the unpalatability of conspicuous (Aposematic) insects and the validity of the results obtained were criticised by W. L. McAtee in 1912 (17) and again in 1932 (18), the years in which I wrote a reply (19). A few months later, on December 7th, the subject was discussed at the Entomological Society of London. The full report appears on pp. 79-105. Dr McAtee's rejoinder was communicated to the Society on 4th October 1933, appears in Pt. II of the *Proceedings*, pp. 113-120, and was followed by replies on 2nd May 1934, pp. 21-40, and by H. B. Cott's paper with four plates, pp. 109-120, including a brief ter-

acters, under the impression that these will be of greater aid in distinguishing between bees that are sometimes superficially very similar.

Key to Workers of *Trigona* from Borneo[1]

1.—The head and thorax roughened with an exceedingly dense tessellation that is devoid or virtually devoid of shiny interspaces. The mesonotum bordered laterally as well as anteriorly and posteriorly by scalelike hairs that frequently produce a symmetrical, well-defined frame of uniform thickness; in other cases the scalelike hairs are more extensively spread anteriorly and posteriorly than along the sides, with resulting irregularity of the borders and encroachment on the disc, but usually there is a surviving bare area at least medianly .. 2

The head and thorax either entirely smooth and polished, or with sculpturing so sparse and delicate that the shininess of the surface is usually dulled only, if at all, by the presence of hairs 5

2.—The hind tibiae enormously expanded, at their widest fully half as wide as they are long and twice the width of the also very wide hind metatarsi; a little more than the apical half of the external surface of these tibiae occupied by a very deep and decisive, almost circular depression. Fairly large, about 6 mm. to 7 mm. in length . . 3

The hind tibiae about one-third as wide toward the apex as they are long. The first abdominal segment cream-colored or fulvous, with frequently a dark stripe or spot to each side of the basal concavity Smaller bees, 3 1/4 to 5 mm.. . . 4.

3.—The length of the malar space about half the width of the mandible at its base The bristles on the vertex black. The trochanters at least beneath and the terminal joints of the tarsi ferruginous; the other joints of the leg black The abdomen viewed from above for the most part sooty red . . . . I. *trochanterica* Cockerell

The length of the malar space about one-third the width of the mandible at its base. The bristles on the vertex fulvous. The coxae, trochanters, greater part of the front and middle femora, the hind femora basally and posteriorly, and the terminal joint of the tarsi reddish; the other parts of the leg black. The abdomen viewed from above a clearer red II. *fulvopilosella* Cameron.

4.—The head, thorax, legs, and tergites 2–6 of the abdomen black; tergite 1 cream-colored. The posterior tibiae fringed with pale hairs, their apex with a tooth anteriorly (Pl. VII, fig. Y). Length 3 1/4 to 3 1/2 mm .... III. *ventralis* Smith.

The following parts fulvous:—mandibles except their apical tips and black basal prominences; a transverse stripe along the apex of the clypeus expanded at each of the lateral extremities; base of scape in front; tegulae; the fore legs largely or wholly; middle coxae, trochanters, femora, tibiae more or less

[1] The reader is also referred to other existing keys in which Bornean *Trigona* or other Indo-Malayan *Trigona* are included, as follows:—
Bingham, 1897, "Fauna of British India—Hymenoptera," I, pp 560 561
Cameron, 1908, The Entomologist, XLI, pp. 192 193
Cockerell, 1918, Annals and Mag. Nat. Hist , (9), II, p 387.
Cockerell, 1919, Philippine Journal of Science, XIV, p 78.
Cockerell, 1923, Annals and Mag. Nat. Hist , (9), XII, pp. 240–242.

and tarsal joints beyond the metatarsus; hind coxae and trochanters wholly or beneath, hind femora beneath and within, hind tibiae slightly at the base, the small joints of the hind tarsi; tergites 1, 5, and 6, sometimes also 2. Hind tibiae somewhat spoon-shaped, with nearly as strong a convexity along the anterior margin of the apical half of the joint as there is along the posterior margin of the apical half; the fringe along the posterior margin of the hind tibiae black. Length 4-5 mm...IV. *terminata* variety *latebalteata* (Cameron).

5.—The basal half of the forewing to the stigma stained a deep brown, usually verging on black, with the venation in this basal region likewise dark; the apical half of the wing a sharply contrasting milk white; the stigma ferruginous to orange-colored, and similarly colored or paler are the veins of the apical half of the wing. (Pl. VII, fig. Z)..... .. . . 6.

The forewing without such a sharp contrast between the basal and the apical half, usually rather uniform in clarity or in tint, whether hyaline, yellowish, or fuliginous, although sometimes a more decided yellowish or orange in the median cell. Venation rather uniform in tint basally and apically. 9.

6.—The malar space short, the distance between the base of the mandible and the rim of the eye less than the width of the scape. Black, with a ferruginous maculation on the clypeus. [With somewhat reddened thorax, *collina* variety *fuscibasis* (Cockerell)]. Length about 4 1/2 mm. ... V. *collina* Smith.

The malar space well developed, emphatically longer than the scape is wide. Larger, 5 to 7 mm.. . . .... 7.

7. Wholly black with black hairs. The mandible with two moderately developed teeth inwardly on its apex, the innermost somewhat the larger of the two Length about 7 mm . . . .VI. *hobbyi*, new species.

The clypeus, usually at least the adjoining parts of the sides of the face (and sometimes much more extensively), the supraclypeus, scape, and tegulae fulvous or testaceous yellow. The mandible for the most part deep reddish, with two unusually large black teeth on its inner side toward the apex, the innermost and larger of the two springing from a level nearly one-half the distance toward the base of the mandible, the anterior tooth almost level with the edentate outer part of the apex of the mandible (Pl. II, fig. D). Length from 5 1/2 to 6 mm.. . . . .8.

8.—The fulvous maculations of the sides of the face not extending upward beyond the base of the clypeus, sometimes even rather obliterated, the entire upper part of the head being black. The thorax black or blackish. The legs with considerable black . . . . VII. *apicalis* Smith.

The head almost completely fulvous, with the black usually confined to a subtriangular area the base of which is the supraorbital line and the apex the space between the antennal sockets. The prothorax and mesopleura fulvous. The legs with little or no black .VIII. *apicalis* variety *binghami*, new variety.

9.—The hind tibiae (Pl. IV, fig. P) very wide and conspicuous, almost half as wide as the joint is long; the hind metatarsi relatively narrow, about one-half the width of the tibiae and rather parallel-sided, with their inner surface covered completely with bristles, not with a differentiated smooth area without bristles at the base (Pl. IV, fig. P[1]). The malar space moderately developed, the shortest distance between eye and mandible only about one-third of the width of the mandible at the base. The mandible with two unusually large teeth

on its inner side, the innermost of the two springing from a level about one-half the distance toward the base of the mandible (Pl. II, fig. A). The clypeus short and wide; on its lower half, where it is rather abruptly expanded, somewhat more than twice as wide as the clypeus is long. Robust; much of head, especially over its lower half or two-thirds, usually fulvous or rufo-testaceous, but sometimes darker [*fimbriata* variety *melanotricha* (Cockerell)]. Length 7 1/2 mm. to 7 3/4 mm.; length of forewing about 8 3/4 mm. Median cell orange fulvous. IX. *fimbriata* Smith.

Not having this combination of characters. Hind tibiae frequently wide but not as emphatically so . . . . 10.

10.—Hind basitarsi with light golden bristles over their entire inner surface. Black and very shiny. The basal half of the clypeus somewhat swollen, raised well above the sides of the face and level with the rather prominent supraclypeus; the apical half somewhat downslanting. The flagellum black both above and below in contrast to the scape. The hairs on head, thorax, legs, and abdomen (above and beneath) exceedingly few and, with the exception of the light golden bristles over the entire inner surface of the basitarsi, all pale Wings clear hyaline. Labrum, mandibles, scape in front, and tarsal joints ferruginous. Very tiny, 2 to 2 1/2 mm. . . . X. *scintillans* Cockerell.

Inner surface of hind basitarsi with a differentiated, flat, bristleless, although frequently sericeous, more or less oval area at the base. (Pl. IV, fig. M[1]) 11

11. The propodeum covered more or less with hair over its middle region, which is somewhat punctate and of subdued sheen [1] The malar space about half as long as the mandible is wide at the base. The mandible with two unusually large teeth on its inner side near the apex, the innermost of the two springing from a level nearly one-half the distance toward the base of the mandible, the anterior one almost level with the narrow edentate outer part of the apex of the mandible (Pl II, fig. C) The thorax, in addition to erect black hairs on mesonotum, scutellum, and mesopleura, has in these areas a dense, woolly, brownish to blackish tomentum Similar dark, woolly tomentum on tergites 3–6. The venter with black hairs. Length 5–6 mm.. XI. *canifrons* Smith.

The propodeum hairless and polished over its middle region. The malar space either exceedingly short or longer than one-half the width of the mandible at the base 12

12. The malar space very short, the inner angle of the mandible almost in contact with the rim of the eye or with only a narrow linear separation, the intervening space where eye and mandible are closest being at most one-quarter of the width of the mandible at the base, usually much less Only minute appressed hairs on clypeus, which is without erect bristles. Small bees to bees of intermediate size, 2 1/4 mm. to 5 1/2 mm. . . . . 13.

The length of the malar space at least a little more than one-half the width of the mandible at the base and usually not much shorter than, or even as long as, the mandible is wide at the base. . . . . 21.

13.—The head, thorax, tegulae, and legs wholly or predominantly black or approximately black (tegulae sometimes rufo-piceous). The abdomen black or sepia brown or banded. . . . . .14.

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[1] See comments also under *flaviventris*, p. 320

At least the tegulae and legs wholly or predominantly honey-colored to ferruginous; the abdomen usually so but in individual specimens sometimes more or less darkened over the apical and occasionally also the basal segments. The stigma and venation of the wings ferruginous.... .... 18.

14.—Very small bees, 2 1/2 to 3 1/4 mm. in length. Ventral surface of abdomen with whitish hairs 15

Larger, fully 4 mm. to 5 mm. in length... 17

15.—Slightly larger, 3 to 3 1/4 mm., and considerably more robust. The hairs on the vertex black. On the mesonotum and scutellum there are usually some black hairs, especially fringing the scutellum posteriorly, although pale hairs predominate. The bristles on the inner surface of the hind basitarsi blackish..................... .... XII. *iridipennis* Smith.

(See also XII A, ?*erythrostoma* Cameron).

Tiny, length about 2 1/2 to 2 3/4 mm., comparable in size and delicacy of structure to the minute *scintillans* (see *ante*) but clypeus barely, if at all, raised above the level of the sides of the face, so very gradually arched that it seems flat, and without difference of elevation between its basal half and its apical. Clypeus, sides of face, and front covered densely with appressed microscopic, whitish hairs. The frontal suture very deep. The hairs on the mesonotum, scutellum, mesopleura whitish, and a fine fringe of whitish hairs usually framing the mesonotum on each side and especially the scutellum along its posterior margin. The bristles on the inner surface of the hind basitarsi (exclusive of the bristleless area at the base) pale golden . ... .16.

16.—The abdomen viewed from above pallid testaceous; the tergites, exclusive usually of tergite 1, broadly banded with fuscous of varying degrees of distinctness. The abdomen viewed from below pallid testaceous to ivory-colored; the sternites without dark bands . .XIII. *fusco-balteata* Cameron

The abdomen rather dilute sepia brown, the hind margin of segment 1 broadly pellucid whitish.... . ... XIV. *atomella* Cockerell

17.—The wings somewhat milky, due to the presence of rather dense, ultramicroscopic hairs, but suffused with orange, more deeply so in the median cell; the veins and stigma bright fulvous. The short tomentum on the clypeus and sides of face dense and dark grayish brown. The mesopleura with the longer hairs predominantly black. Tegulae fairly shiny. The hairs on the under side of the abdomen and on the apical tergites black. Length 5 mm. . ...XV. *rufibasalis* Cockerell.

Wings rather uniformly hyaline to yellowish. Clypeus, sides of face, and front with silvery gray, short, tomentum that is rather dense. The mesopleura with silvery gray hairs and silvery gray tomentum. The hairs on the under side of the abdomen silvery gray. Length 4 to 4 1/2 mm.. . . .. XVI. *confusella* Cockerell.

18.—The thorax predominantly black. Some of the joints of the leg somewhat darkened, the middle and hind basitarsi usually so. Length 3 1/2 to 4 mm. ... .XVII. *sarawakensis*, new species.

The thorax honey-colored to ferruginous.... .... 19.

19.—The head black except for the clypeus, labrum, mandibles, scape, and flagellum beneath. Length 3 1/2 to 4 1/4 mm ....XVIII. *melanocephala* Gribodo.

The head usually wholly honey-colored to ferruginous, except that the flagellum is usually dark above; the upper part of the head sometimes a little darkened. .... 20.

20. —Very small, 2 1/2 to 3 mm. in length.......... XIX. *pallidistigma* Cameron.
Conspicuously larger and more robust, 4 1/2 to 5 mm. XX. *melina* Gribodo.

21.— The wings lightly suffused with orange, sometimes more or less milky toward the apex, their stigma and venation bright fulvous. The abdomen usually more or less castaneous, or partly reddish or testaceous and partly black, or wholly red, rarely wholly black. Relatively large *Trigona*, upward of 6 mm. .... 22.
The wings hyaline to more or less dilute fuliginous, with the stigma and venation dull brownish to dark. Abdomen black, or sometimes with a pale stripe on tergites 1 and 6 Smaller, 3 1/4 to 6 mm .... 25.

22 —The head black, with clypeus, supraclypeus, and basal half to two-thirds of scape fulvous to rufous. The thorax likewise fulvous to rufous and densely tomentose ("mosslike pubescence," Cockerell). The malar space fully as long as the mandible is wide at the base. Inner one-third of apex of mandible with two teeth, one of which constitutes the inner angle (Pl III, fig. J). The hind metatarsi very broad, nearly as broad as their tibiae (Pl. VII, fig. W). Length 8 to 9 mm. ....
XXI *thoracica* variety *lacteifasciata* (Cameron) and associated forms.
The head, thorax, and legs black The malar space subequal in length to the width of the mandible at the base. Length 6 to 7 mm. 23

23 —The largely or wholly dark mandible with only a single, moderately developed tooth on the inner edge of its apex (Pl III, fig. K) No erect black bristle-like hairs on the clypeus, merely grayish down or tomentum like that of the sides of the face. .... XXII. *erythrogastra* Cameron
The deep red mandible with two unusually large teeth on its inner side, the innermost and larger of the two springing from a level nearly one-half of the distance toward the base of the mandible (Pl. II, fig. B). The clypeus with conspicuous erect black bristles .... 24.

24. —Scape dark castaneous in back, rather bright ferruginous in front. Tergites of abdomen black. Trochanters with a red stripe above..
.... XXIII. *haematoptera* variety *haematoptera* Cockerell
Scape black, with merely the extreme base and antennal sockets reddened Tergites of abdomen more or less castaneous basally with fragmentary to sometimes complete bands of usually a deeper brown to blackish along the apex of each. In addition to the blackish bands at the apex, there is frequently a very narrow curvilinear blackish band extending transversely across the middle of, particularly, tergites 2-3. ....
.... XXIV. *haematoptera* variety *dulitae*, new variety.

25 —Smaller, 3 1/4 to 3 1/2 mm. long. The mandibles except for their black apical edge and basal prominences, deep red as is also the apical one-third to one-half of the clypeus. The mandibles with two denticles—the innermost slightly the larger—on the inner two-fifths of apex. The erect hairs on the mesopleura whitish like the tomentum, contrasting with the erect black hairs anteriorly on the mesonotum and with the denser and longer black hairs on the scutellum. Tergite 1 with an ivory-colored, somewhat membranous

transverse stripe at the apex, and tergite 6 with its apical tip ivory-colored. ....XXV. *moorei*, new species.

Larger, 5 mm. to 6 mm. long. The mandibles wholly or for the most part, the clypeus, the scape (except at its extreme base) are black. The mandible with only a single tooth toward the inner edge of the otherwise edentate apex (Pl. III, fig. L). The erect hairs (as distinguished from the feathery dull gray tomentum) on the mesopleura black .... 26.

26.--Malar space about two-thirds as long as the mandible is wide at the base.. . ... XXVI. *itama* Cockerell.

Malar space a little more than half as long as the mandible is wide at the base. .... XXVII. *breviceps* Cockerell.

I.—**Trigona trochanterica** Cockerell

Trigona trochanterica COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 115.

Trigona trochanterica Cockerell, the type of which I have examined, was described from Borneo. It belongs to the group with densely tessellated head and thorax but is especially distinguished by its enormously expanded hind tibiae—See key. Structurally it would seem to be identical with *nitidiventris* Smith, from Mt. Ophir, which I have seen in the Saunders collection at Oxford. This specimen of *nitidiventris* is labeled "M. Ophir 79" and is assumed—and I think correctly—to have been part of the material on which Smith's description was based.

Although Smith says nothing in his description regarding the sculpturing of the head and thorax of *nitidiventris*, the contrast between their condition and that of the abdomen is perhaps implied in the name Smith gave the insect and in his emphasis on the fact that the abdomen is shining black. Smith speaks of the "margins of the thorax and scutellum" of *nitidiventris* as having ochraceous pubescence; but as a matter of fact, while there is a thin border of hairs in the Oxford specimen along the lateral margins of the mesonotum, by far the greater abundance and extent of such hairs is anteriorly and posteriorly (especially posteriorly) on the mesonotum, conforming with the condition specified by Cockerell for *trochanterica* and revealed by his type specimen. Smith's description of the wings of *nitidiventris* as "subhyaline and iridescent, slightly fuscous toward their base" does not seem to me to fit the Oxford specimen of *nitidiventris* as accurately as the description Cockerell gives of the wings of *trochanterica:* "wings yellowish, nervures and stigma ferruginous." The wings are a little more yellowish in the median cell of *nitidiventris* than in the apical region. The impressively widened hind tibiae are characteristic of both the Oxford specimen of *nitidiventris* and *trochanterica,* and other minor points of agreement

are the "greyish-olivaceous pruinosity" of the face, the dull reddish tegulae, the more or less reddish trochanters and claw-joints of the tarsi, and the pale red of the ventral aspect of the abdomen.

The following differences should be noted:—Although in both insects the scape is mainly black with only the extreme base ferruginous, the flagellum in *nitidiventris* is black, in *trochanterica* "dark reddish, with the first joint black, and the very short second one pale reddish beneath;" the stiff bristles on the vertex are fulvous in *nitidiventris* but black in *trochanterica*. Also, *nitidiventris* has the abdomen black rather than dark reddish, as specified for *trochanterica; nitidiventris* is not "more distinctly reddened at the sides of the second segment," as specified for *trochanterica*, although it shares with *trochanterica* the red patch on each side of the fifth tergite and has the sixth tergite red. In size *nitidiventris* slightly exceeds *trochanterica*.

In the British Museum is a specimen from the Smith collection which was obtained at Mt. Ophir, the type locality of *nitidiventris*. It, too, is designated *nitidiventris* and has the word "type" written on the accession label. It is utterly different from the Oxford University Museum specimen of *nitidiventris* and departs widely, also, from the description of *nitidiventris*. I regard it as very close to what Cockerell described as *itama*, but it cannot possibly be the type of *nitidiventris*.

An insect that is a very near relative of *nitidiventris* as represented by the specimen at Oxford is *fulvopilosella* Cameron.

Trigona trochanterica is not represented in the collection of the Oxford University Sarawak (Borneo) Expedition.

II.—**Trigona fulvopilosella** Cameron

Trigona fulvopilosella Cameron, 1908, The Entomologist, XLI, pp. 192–193, 194

The type material of *fulvopilosella* in the British Museum consists of two specimens, both from Kuching, Borneo, with dates Oct., 1906 and May, 1907, thus corresponding as to place and month with the record connected with the description. Also on the labels are the initials J. H., undoubtedly standing for the name of the collector, John Hewitt. There can be little doubt that these specimens are the authentic types of *fulvopilosella*.

This species is very close to *trochanterica* Cockerell but differs by the slightly shorter malar space. Differences of coloration between *fulvopilosella* and *trochanterica* are noted in the key.

An even closer relative is *Trigona latipes* Friese, described from Singapore. I have seen a metatype from this locality which seems to

differ from *fulvopilosella* mainly in the still greater predominance of red, such areas as the upper half of the mesopleura, the metapleura, and the entire abdomen, not to mention the coxae, trochanters, and femora, being a clear bright red.

Trigona fulvopilosella is not represented among the specimens collected by the Oxford University Sarawak (Borneo) Expedition.

III.—**Trigona ventralis** Smith

(Pl. III, fig. 1; Pl. VII, fig. Y)

Trigona ventralis SMITH, 1857, Journ of Proc. Linn. Soc. Zool, II, p. 50. (Specimens from Sarawak only)

Melipona ventralis DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 584.

Melipona ventralis BINGHAM, 1897, 'Fauna of British India Hymenoptera,' I, pp 561, 562–563.

Trigona ventralis COCKERELL, 1923, Annals and Mag. Nat Hist., (9), XII, p. 241.

Trigona ventralis COCKERELL, 1929, Annals and Mag Nat Hist, (10), IV, pp 139, 591–592.

Trigona ventralis FRIESE, 1933, Naturh. Maandblad, XXII, p. 147.

Smith's *ventralis* was described on the basis of specimens obtained from Sarawak, Borneo, and Mount Ophir, Malacca. It seems almost certain that the material was composite, and that the Borneo specimens were *ventralis;* the Mount Ophir specimens, on the other hand, *latebalteata.* The ground for this suspicion is the fact that the Smith specimen at Oxford, bearing on the label the wording "M. Ophir 77," departs from Smith's description of *ventralis* by its larger size, by having the various maculations associated with *latebalteata* (see key in present paper) and by having the hairs that fringe the hind tibiae black—the condition in *latebalteata*—not pale, as called for in the description of *ventralis* and as exemplified in the Bornean specimens here assigned to *ventralis.* Fortunately there is among the specimens in the British Museum a specimen labeled *ventralis* from the Smith collection that has the legend "Sar.," standing for Sarawak, with "Borneo" on the under side of the label. This specimen, which is *ventralis* as usually interpreted, is, it seems reasonable to suppose, probably one of the specimens from Sarawak that Smith had before him when describing the species. Cockerell (1929, Annals and Mag. Nat. Hist., (10), IV, p. 591) has previously taken the stand that Sarawak must be held to be the typical locality.

The specimens here assigned to *ventralis* have a black spot on each side of the pale segment 1 of the abdomen, as noted by Bingham (1897, p. 563) and in Cockerell's key to the *Trigona* of the Malay region (1923,

Annals and Mag. Nat. Hist., (9), XII, pp. 240-241). These black spots are present also, according to the description of Gribodo (1891, Bullet. Soc. Entomol. Italiana, XXIII, p. 109) in his *Trigona javanica*, and they occur likewise on the first abdominal segment of Smith's *terminata* and Cockerell's *fulvomarginata*, the type of which I have seen. They are also faintly present on the specimen here determined as *latebalteata*. In *Trigona arcifera* Cockerell from Testa Bridge, Himalayas, India, which is closely related to *ventralis*, there is instead of these spots a semicircular dark brown band bordering the basal concavity of the first segment. The length of *ventralis* is given by Smith as 1 2/3 lines, approximating the size of the specimens here reported upon, which measure 3 1/4 to 3 1/2 mm. A specimen of *fulvomarginata* from Pat Meeung Mts., Siam, Jan. 18, 1928, is larger and more robust, measuring about 4 1/2 mm., which approximates the measurement, 4–5 mm., that Gribodo gives for *javanica*. Smith's *terminata* was 2 1/2 lines in length. Cockerell (1929, Annals and Mag. Nat. Hist., (10), IV, p. 591) well discusses the differences between these several rather closely related insects. The flagellum in three out of the four specimens here assigned to *ventralis* is almost uniformly black (except for the sometimes lighter colored joint 2) rather than rufo-fuscous as described by Smith.

Specimens of *ventralis* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: foot of Mt. Dulit, junction of rivers Tinjar and Lejok, on "Dulit Trail," Aug. 16, 1932, two workers; Mt. Dulit, R. Lejok, "near sweat and water," Oct. 5, 1932, two workers.

IV.—**Trigona terminata** variety **latebalteata** (Cameron)

Trigona ventralis Smith, 1857, Journ. of Proc. Linn. Soc. Zool., II, p 50. (Specimens from Mt. Ophir but not those from Sarawak.)

Trigona latebalteata Cameron, 1902, Journal Straits Asiatic Soc., XXXVII, pp. 130–131.

Trigona latibalteata Cameron, 1908, Entomologist, XLI, p. 193.

This species shares with *ventralis, fulvopilosella,* and *trochanterica* the condition of having head and thorax densely tessellated without shiny interspaces. The mesonotum is enclosed by a square formed by minute, rather scalelike hairs in the case of *ventralis* and *latebalteata;* in *trochanterica* such hairs are present anteriorly and posteriorly on the mesonotum but do not border or only very thinly border the sides. *Trigona javanica* Gribodo would seem to be a very close relative, distinguishable from *latebalteata* possibly mainly by the maculation of the legs, which in *javanica* are described as being rufo-fuscous or rufo-

ochraceous whereas in *latebalteata* the hind tibiae and metatarsi are black. *Trigona latebalteata* is also approached by *fulvomarginata* Cockerell. In *fulvomarginata*, the type of which I have seen, "the coxae, trochanters, and middle femora are light ferruginous," also the front femora, whereas in *latebalteata* the ferruginous areas on the leg are more extensive (see the specifications in the key under 4). Thus *latebalteata* with respect to the maculation of the legs stands about midway between *javanica*, with its mainly reddish legs, and *fulvomarginata*, with its mainly black legs. The hind tibiae of *latebalteata*, *fulvomarginata*, and also to some extent *javanica* are fringed posteriorly with black hairs. This is also the case in *terminata* Smith (1878, Journ. Asiat. Soc. Bengal, XLVII, Pt. 2, p. 169), the otherwise much mutilated type of which fortunately still retains the hind legs. In *ventralis*, on the other hand, as Cockerell has pointed out (1929, Annals and Mag. Nat. Hist., (10), IV, p. 591), the fringe is pale. Furthermore, *ventralis* is distinguished from all the related insects mentioned by its smaller size. *Trigona nitidiventris* from Mt. Ophir and *fulvopilosella* and *trochanterica* from Borneo are easily distinguished from their near relatives, including *latebalteata*, by their unusually large hind tibiae—see key.

Trigona latebalteata is represented in the British Museum by two specimens marked "type." Both of these bear on the label the designation "Kuching, Sarawak," which is the type locality. One of the specimens, dated July 17, 1900, and further labeled "P. Cameron Coll. 1914-110" is much mutilated, with merely the thorax and some of the joints of the leg surviving. The other specimen, dated July 18, 1900, with the number 1903.249, is nearly perfect and agrees with the specimen from the foot of Mt. Dulit collected by the Oxford University Sarawak (Borneo) Expedition.

The type specimen of *terminata* (79.22) in the British Museum lacks a locality label. Its head, one pair of wings, and hind legs are in perfect preservation; the thorax is much mutilated; the fore and middle legs and the abdomen are lacking. The parts present justify one, I think, in believing that *terminata* is structurally an insect of the same pattern as *latebalteata*. The hind leg of the type of *terminata* has the coxa, trochanter, and small joints of tarsi ferruginous, and the inner surface of the tibiae dusky ferruginous. Smith's description mentions only the tarsi as ferruginous, with the implication that the other joints of the legs are darker.

The following specimen of *latebalteata* was collected by the Oxford University Sarawak (Borneo) Expedition:

minal note stating that I did not propose to continue the discussion.

The following publications by four naturalists are of much significance in relation to Dr McAtee's criticisms.

I wish that space permitted an adequate account of Dr Frank Morton Jones' paper on " Insect Coloration and the Relative Acceptability of Insects to Birds " (20), describing experiments conducted on the island of Martha's Vineyard, Massachusetts, in 1930 and 1931. A feeding-tray was set up at the edge of an extensive woodland and supplied with water and food so that birds of several species were attracted to it; then from time to time freshly killed insects were placed upon the tray instead of or in addition to the other food and the visits recorded, having been observed from a distance through field-glasses. The extremely careful discussion of the evidence obtained led the author to conclude that, although insect acceptability to birds is relative, coloration has material influence upon it. Further experiments also proved that certain insects feeding on poisonous plants are refused by ants as well as by birds and also indicated that in these instances, but not in others, the deterrent qualities are derived from the plants. Two years later Dr Morton Jones published an account (21) of further experiments in the same locality in 1932-33, and in S. Florida during March and April 1933. The results of the earlier work were confirmed and the conclusion reached that " acceptability of insects is determined, not primarily by numbers and availability, but by bird preferences " (p. 452).

An important paper (22) published by Dr H. N. Kluijver in 1933 proves that the Starlings of two colonies near Wageningen, Holland, certainly show preferences and discrimination in selecting insect food for their young; also that McAtee has not convincingly shown that so-called protective adaptations are of no importance. R. Carrick in his very interesting and convincing " Experiments to test the efficiency of protective adaptations in insects " (23) proved that a bark-like geometrid larva motionless on a bare twig of hawthorn fixed near a nest containing young, was unseen by the parent wren but seized when lying on a tray below the nest. Finally, Prof. F. B. Isely has conducted extremely interesting and successful experiments upon the " Survival Value of Acridian Protective Coloration " (24), exposing the insects upon plots of differently coloured soil and recording the effect of attack by enemies upon those which harmonised with the surroundings as compared with those which contrasted.

I had hoped to conclude with brief reference to Prof. Hale Carpenter's replies to recent criticisms of natural selection as applied to insect ecology and to the evidence of bird attacks on butterflies which he has collected; also to the fine work of very many naturalists, especially in Africa, but the limit imposed by the editors is already much overpassed and I must regretfully bring this imperfect statement to a close.

REFERENCES.

1. *Travels in the Interior of Southern Africa*, Vol. I, Lond., 1822, pp. 310, 311.
2. *Ibid.*, p. 226. The same conclusions appear in a letter written by Darwin to G. H. Lewes in 1868 (*More Letters*, 1903, i, 308).
3. *Zoonomia*, i, 509, Lond., 1794.
4. *Life and Letters*, 1887, i, 235, 236.
5. See *Life and Letters*, iii, 93, 94, 1887, for two of Darwin's letters to Wallace in 1867; also the footnotes on p. 94.

Sarawak: foot of Mt. Dulit, junction of rivers Tinjar and Lejok, Dulit Trail, primitive forest, Aug. 16, 1932, one worker.

V.—**Trigona collina** Smith

(Pl. II, fig F; Pl V, fig. S)

Trigona collina SMITH, 1857, Journ. of Proc. Linn. Soc. Zool., II, pp. 51–52.

Melipona collina DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 577.

?*Melipona collina* BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560, 562

Trigona collina CAMERON, 1908, Entomologist, XLI, p. 192.

Trigona collina COCKERELL, 1920, Annals and Mag. Nat. Hist, (9), V, p. 116.

Trigona collina COCKERELL, 1923, Annals and Mag. Nat Hist, (9), XII, p. 241

Trigona collina, the type of which I have seen, has the head and thorax polished, not opaque as indicated by Bingham ('Fauna of British India -Hymenoptera,' I, p. 562). The hind legs of the type are missing but the characters present give confidence in assigning the specimens collected by the Oxford University Sarawak (Borneo) Expedition to this species. Especial significance should be ascribed, in my estimation, to the much reduced malar space evidenced by the type of *collina* and the specimens here placed in that species. One discrepancy should be noted. The almost complete absence of hair on the mesonotum of the type specimen as against the presence of hair on the others. However, an aggregation of hairs of normal density on a small area of the mesonotum prompts the suspicion that their absence over the greater part of the disc is due to wear and represents an abnormal condition. Indeed Smith in his description indicates "the disk of the thorax with a cinereous pile."

As *collina* Smith as I interpret it on the basis of the type and the description has been frequently confused with *apicalis* Smith, it is worth emphasizing its distinctive characters smaller size, 2 1/4 lines as against 2 1/2 (actually still larger) specified for *apicalis;* the clypeus with "a pale spot in the middle," not as in *apicalis* with "the clypeus, the lower parts of the face, testaceous yellow," and finally, most important of all, although not mentioned by Smith, the much shorter malar space of *collina*.

Very close to *collina* is Cockerell's *cambodiensis*, the type of which I have seen. In *cambodiensis* the malar space is much reduced, wings with a sharp contrast between the dark basal half and milky apical half, mainly black hair on thorax, legs, and abdomen, in all of these respects resembling *collina*. From *collina*, however, *cambodiensis* may be differentiated by having a median longitudinal keel on the clypeus,

more distinctly ferruginous mandibles, "sordid white" instead of mouse-colored to blackish tomentum to each side of the median polished area on propodeum.

Cockerell separates his *fuscibasis* from *collina* by its shiny head and thorax, thus following Bingham in regarding these parts as dull in *collina*. The insect here interpreted as *collina* is structurally essentially the same as *fuscibasis*, and *fuscibasis*, it seems to me, is separable from it at most as a variety that has the mesothorax dark chestnut red instead of black and that has the tegulae clear red.

The nest which Waterhouse ascribed to *collina* (1903, Trans. Ent. Soc. London, pp. 133–134) is, on the basis of the associated insects, which I have examined in the British Museum, a nest not of *collina* but of *apicalis*.

Cockerell, who examined specimens of Cameron in the collection at Cambridge University, found one labeled Patalung, Malay Peninsula (Skeat), with the designation *collina*. This interpretation Cockerell did not accept (1923, Annals and Mag. Nat. Hist., (9), XII, p. 242). I have not seen the specimen at Cambridge but a specimen in the British Museum with identical data as to collecting site and collector and with, in addition, a label reading P. Cameron Coll. 1914-110, seems to me correctly identified as *collina*

Specimens of *collina* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, 4000 ft., "waterfall, moss forest," Oct. 22, 1932, one worker; Mt. Dulit, R. Koyan, 2500 ft, "primitive forest," Nov. 17, 1932, one worker.

VI.—**Trigona hobbyi**, new species

WORKER.—Entirely black except for the ferruginous antennal sockets, basal half of tarsal claws, veins of apical half of wing, and a faintly dull reddish, narrow area near the apex of the mandible. The erect hairs uniformly black except that the metatarsal brushes, especially those of the anterior legs, have a coppery tinge. For the most part shiny and sculptureless.

Head broader than long and extending slightly beyond the outer rims of the tegulae; eyes barely convergent below; malar space very long, nearly as long as the mandible is wide at the base; apex of mandibles curvilinear in profile, its outer two-thirds edentate, its inner one-third with two distinct teeth, of which the innermost is somewhat the larger; apico-lateral corners of rather flat, six-sided clypeus exceedingly remote from eye; the genae somewhat broader than the eye. The head mostly smooth and shiny, the clypeus, sides of face, front, genae, and scape with fine, appressed, black, ultramicroscopic hairs; the upper part of front, vertex, labrum, inferior margin of mandibles and lower part of genae with black bristles, those on the

vertex coarse. The clypeus with a very few scattered, shallow but fairly large punctures laterally on its anterior half that contrast with the inconspicuous and almost negligible, ultrafine punctation over the entire face that apparently corresponds with the points of emergence of the fine hairs.

The thorax smooth and fairly shiny although abundantly covered with black bristles on mesonotum (especially anteriorly), scutellum, mesopleura, tubercles, and tegulae anteriorly. In addition, there is darkish tomentum over these areas; the tomentum to each side of the shiny bare median area of the propodeum a little more grayish brown in some lights.

Rather long, erect, black hairs on the coxae and trochanters beneath, contrasting with the rather inconspicuous hairs beneath on the otherwise largely bare femora, the outer side of the front tibiae with very short, stiff, downsloping, black hairs, much shorter than the erect black hairs on the outer side of the front and middle basitarsi, and contrasting strongly with the conspicuously hairy outer side of the middle tibiae with its dense growth of erect, plumose hairs The hind tibiae gradually broadened from base to apex, their posterior margin convex, their anterior margin a little concave on the basal half, more convex toward the apex, which is subtruncate; the anterior margin with a thin fringe of simple, black hairs, the posterior margin with a much denser fringe of black, plumose hairs; such plumose hairs cover densely also the basal half of the exterior surface, with stray simple hairs scattered over the somewhat depressed apical half

The basal half of the wing dark brownish, with its venation dark; the apical half of the wing of a sharply contrasting milk white, the stigma, marginal vein, and that part of the costal vein apicad to the stigma a bright ferruginous to orange color. Tegulae black.

The abdomen about the width of the thorax, the first four tergites (which in the specimen on which this description is based are fully exposed) polished and shiny, without sculpturing except for faint fine tessellation at the extreme sides of the apex of tergites 2–4, corresponding with the presence of minute, black hairs which, in the case of tergites 3–4, extend also narrowly along the entire apical margin. Tergites 5–6 more telescoped, their entire exposed surface covered with such minute hairs rather densely and, in addition, with some longer black hairs. The sternites with longish black hairs down the middle that grade into darkish sericeous patches to each side.

Length 7 mm.; width of thorax about 2 mm.; length of forewing 7 1/2 mm.

The key will assist in separating *hobbyi* from several other species from Borneo characterized by similarly colored wings.

Its prevailingly black appearance associates *hobbyi* with the brief description that Lepeletier (1836, 'Histoire naturelle des Insectes – Hyménoptères,' I, p. 429) gives of *vidua* from the Island of Timor. The description is so brief, however, that reliance cannot be placed upon it. In Bingham's key (1897, 'Fauna of British India—Hymenoptera,' I, pp. 560–561) *hobbyi* runs to *vidua* but Bingham's brief redescription of *vidua*, supplied in the same work (p. 585), does not tally with *hobbyi*, such statements as "head and thorax dull and opaque," "face in front

with a thin cinereous pile," "antennae and the anterior tarsi brownish" being inapplicable. Indeed the single specimen from the Bingham collection labeled *vidua* in the British Museum is structurally like *apicalis*.

Cockerell (1926, Annals and Mag. Nat. Hist., (9), XVIII, p. 224) expresses the opinion that Bingham may have included in his conception of *vidua* what Cockerell described as a new species (*cambodiensis*) from Angkor, Cambodia. The "clear red scape" "the pale yellowish red" under-surface of the antennae, its smaller size, etc., are superficial characters that separate *cambodiensis* from *hobbyi*, while structurally it differs notably from *hobbyi* by having a much reduced malar space-- only a little more than linear (see account of *cambodiensis* under *collina*).

The description of *melanoleuca* Cockerell (1929, Annals and Mag. Nat. Hist., (10), IV, pp. 140–141) applies rather well to *hobbyi* in many respects although *melanoleuca* has "very fine pale pruinose pubescence" over its face whereas *hobbyi* has this pubescence black. However, the malar space of *melanoleuca* is ever so much smaller than is the case in *hobbyi*.

Description based on a single specimen from Sarawak: Mt. Dulit, 4000 feet, moss forest, Oct. 18, 1932, collected by the Oxford University Sarawak (Borneo) Expedition.

VII.—**Trigona apicalis** Smith

Trigona apicalis SMITH, 1857, Journ. of Proc. Linn Soc. Zool., II, p. 51.

Melipona apicalis DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 575.

Melipona apicalis BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560 and 562 (In part only, the majority of the specimens of the Bingham collection in the British Museum being assignable to the variety *binghami*.)

Trigona collina WATERHOUSE, 1903, Trans. Entom. Soc. of London, pp. 133–134, Pl. VI (nest and male).

Trigona apicalis COCKERELL, 1918, Annals and Mag Nat Hist., (9), II, p. 387 (in part).

Trigona apicalis COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

Trigona apicalis COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241.

Trigona hemileuca COCKERELL, 1929, Annals and Mag. Nat. Hist., (10), IV, p. 140.

Trigona hemileuca COCKERELL, 1929, Annals and Mag. Nat. Hist., (10), IV, p. 591.

?*Trigona apicalis* FRIESE, 1933, Naturh. Maandblad, XXII, pp. 45, 46.

Trigona sericea FRIESE, 1933, Naturh. Maandblad, XXII, pp. 45–46.

Bingham (1897, 'Fauna of British India—Hymenoptera,' I, p. 562)

noted that *apicalis* varies considerably in different localities. "Specimens from South Tenasserim very closely approach the typical form from Borneo, but are not quite so dark." Many of the specimens that Bingham thus merged with typical *apicalis* have here been placed in the variety *binghami*.

The specimens collected by the Oxford University Sarawak (Borneo) Expedition have rather well-defined black and red areas. Black are: apical half to all of fore femora, apex of fore tibiae briefly, middle coxae, middle femora entirely beneath and at apex also above, middle tibiae briefly at apex and often also extensively anteriorly, middle metatarsus, hind coxae, hind femora entirely beneath and extensively (sometimes entirely) also above, hind tibiae at base and anteriorly at apex (but with red area between black maculations and with red posteriorly at apex). Smith described the legs of *apicalis*, the type of which I have seen, as dark rufo-piceous; the posterior tibiae pale.

Cockerell (1920, Annals and Mag. Nat. Hist., (9), V, p. 116) differentiated his *fuscibasis* from *apicalis* "by the black legs," although the description indicates that in *fuscibasis*, too, parts of the legs ("anterior femora and basitarsi in front, small joints of their tarsi and of the others more or less") are ferruginous. However, *apicalis* and *fuscibasis*, the types of which I have examined, differ fundamentally in respect to the length of the malar space, which is well developed in *apicalis* and merely linear in *fuscibasis*. See discussion of *fuscibasis* under *collina* (p. 298).

The abdomen of the type of *apicalis*, described by Smith as nigropiceous, has the three apical segments suffused with red. The apical segments of the specimens taken by the Oxford University Sarawak (Borneo) Expedition are similarly reddish, and the basal segments, notwithstanding their darker appearance, are inclined to be red at least on their apical rims, a condition observable also in the type specimen.

Before me are paratypes of Friese's *Trigona sericea*, from Sauggau, Borneo, July 24, 1932. Friese (1933, Naturh. Maandblad, XXII, pp. 45–46) differentiates *sericea* from *apicalis* as follows:—

WORKER.—Like *Trigona apicalis* Smith, but somewhat larger, segments 4–6 yellowish brown with short silklike felting. Corbiculum differently shaped, widened toward the end abruptly and spoonlike.

Friese seems to have been misled by the size assigned by Smith to *apicalis*. It is 6 mm., rather than 2 1/2 lines, and thus approximates the dimensions Friese gives for *sericea*, 6–6 1/2 mm. The wing measurement is the same in both insects. I am unable to detect a difference

in the shape of the tibiae of *apicalis* and *sericea*. The term "spoonlike," (löffelartig) applicable to such New World forms as *testacea* and *cupira*, seems here misapplied. The presence of hairs on the apical rims and the lighter, more reddish or yellowish brown coloration of the apical tergites of the abdomen, are characters shared by both the type of *apicalis* and the paratypes of *sericea*.

I am unable to separate structurally *Trigona hemileuca* Cockerell (1929, Annals and Mag. Nat. Hist., (10), IV, p. 140), collected in Siam, a type and cotype of which I have examined, from *Trigona apicalis* Smith as here interpreted. The length recorded for *hemileuca* is greater than that noted by Smith for *apicalis* and greater, too, than that of the present specimens, but the disparity is explained by the distention of the segments of the abdomen in the type. The wing length—a more trustworthy criterion—is approximately the same in *hemileuca* and in the present specimens. The posterior tibiae of the type, at least, of *hemileuca* are red on their external surface (Smith describes the corresponding tibiae of *apicalis* as "pale").

Closely related to but, in my estimation specifically distinct from *apicalis* is *melanoleuca* Cockerell, (1929, Annals and Mag. Nat. Hist., (10), IV, pp. 140–141), the type of which, collected at Nan, Siam, I have examined. It is separable from *apicalis* not only on the grounds of its darker color, lacking the maculations on the clypeus, adjacent parts of sides of face, and tegulae that characterize *apicalis*, but its malar space is less developed, being only about half the width of the mandible at the base, and its hind metatarsi have their posterior edge more nearly straight instead of slanting obliquely to form a rather pronounced apical angle.

Differentiated from the typical variety of *apicalis* by its orange-ferruginous abdomen and almost wholly reddish legs, with the hind tibiae and hind basitarsi fulvous, is *Trigona apicalis peninsularis* from the Malay Peninsula, the type of which I have seen.

The nest described by Waterhouse (1903, Trans. Ent. Soc. London, pp. 133–134) as that of *collina* should be assigned to *apicalis*. I have seen specimens from this nest in the British Museum and, while several of them are callows, they are, I think, indubitably *apicalis*.

Specimens of *apicalis* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, R. Koyan, 2500 ft., in "primitive forest," Nov. 17, 1932, four workers, one of them "collecting resin on tree trunk" and two of them "on tree trunk."

VIII.—**Trigona apicalis** variety **binghami**, new variety

(Pl. II, figs. D and D¹; Pl. V, figs. R and R¹; Pl. VII, fig. Z)

Trigona apicalis BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560–562 (in part, especially specimens from Tenasserim).

Trigona apicalis COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387 (in part).

WORKER.—The variety *binghami* differs from typical *apicalis* by its more extensively testaceous yellow appearance Especially does the contrast in coloration between the two varieties apply to the head. As Smith's description indicates, typical *apicalis* has the head black, with the clypeus and lower parts of the face (the region up to the level of the base of the clypeus and the supraclypeus) testaceous yellow. In contrast, in the variety *binghami* virtually the whole head is testaceous yellow with the exception of usually the malar space and a black triangular area on the front that extends from the supraorbital line to the space between the antennal sockets (and even this triangle may in rare cases be absent or obscure). In typical *apicalis* the entire thorax with the exception of the red tegulae is black. In the variety *binghami*, instead, not merely the tegulae but the prothorax, mesopleura, and sometimes the scutellum and axillae are testaceous yellow. The mesonotum of *binghami* is sometimes darker than the mesopleura, occasionally brownish black to black (this condition is more prevalent in the specimens from Tenasserim than in those from Sandakan). The three pairs of legs are almost wholly testaceous yellow although sometimes the middle and hind metatarsi are more or less darkened. The abdomen is more extensively blackish than any other part of the body, in the Tenasserim specimens wholly so; in the Borneo specimens usually black on the apical rims of at least the three or four basal tergites, sometimes more extensively black but frequently more or less suffused or replaced by castaneous, especially on the apical tergites.

MALE. Very similar in its coloration to the worker, with the head testaceous except for the large black triangle on the front, the blackish malar space, and, in addition, an ill-defined blackish area in back of the summit of the eye. The erect hairs of the head for the most part black as in the worker and with a somewhat similar distribution (apical region of clypeus, mandibles—especially basal half of their inferior margin -front, vertex, and lower part of genae) but longer than the corresponding hairs of the worker In addition to the more conspicuous black hairs there is in the male a tomentum-like felting of paler hairs on the front and vertex and similar minute pale hairs occur anteriorly on the scape. The eyes broader by about one-fourth than in the worker and a little more convergent below, but the face itself narrower. The malar space distinct but much more reduced than in the worker, in length about one-half the width of the flagellum. The mandibles broad at the base, with their basal half triangular, their apical half narrow and parallel-sided, their apex obliquely slanting inward with a single, emphatic denticle (not two) at the inner extremity (Pl. II, fig. D¹).

The thorax dull reddish with the mesopleura invaded by black on their lower half (a condition sometimes found also in the worker). The erect black hairs on the mesonotum finer, less coarsely bristle-like, than in the worker.

The wings as in the typical variety.

The legs testaceous like those of the worker. The hind tibiae (Pl. V, fig. R¹)

about four-fifths as wide as those of the worker (Pl. V, fig. R) and more rounded apically, fringed along their posterior margin, as in the worker, densely with plumose hairs that overlie a very much thinner fringe of simple bristle-like hairs. The hind metatarsi more elongate and a little narrower than in the worker; their inner surface without a differentiated, oval area at the base, covered rather uniformly both basally and apically with blackish bristles.

The abdomen blackish, with invasions of red in the basal depression on tergite 1 and basally on tergites 3–6. The venter rather concave beyond sternite 1, devoid of longer hairs except for a few black ones along the sides of the last three visible sternites, which are bilobed and felted over with short, grayish, sericeous pile. Similar sericeous hairs but darker cover the apical rims of tergites 2–4. On the apical tergites the hairs are long and black.

The description of the male is based on a single specimen from Sandakan, Borneo (Baker) in the collection of the U. S. National Museum.

Bingham himself called attention (1897, 'Fauna of British India—Hymenoptera,' I, p. 562) to the variability of *apicalis* and noted that "Specimens from South Tenasserim very closely approach the typical form from Borneo, but are not quite so dark." Bingham even described a melanistic variety of *apicalis*, but it is impossible, due to the brevity of his description, to decide whether he had before him an insect similar to Cockerell's *melanoleuca* or not.

The specimens here assigned to the new variety *binghami* come from the following localities:

Tenasserim: Salween Valley, October, 1889; Ataran Valley, June and December, 1890; Dawnat Range, Jan., 1891 (type); Thaungyin Valley, Jan., 1891; Alaran Valley, June, 1891; Maulmain, Feb., 1894. (All collected by Col. C. T. Bingham.)

Upper Burma: Nanpandet, Nov. 21, 1899. (Col. C. T. Bingham)

Borneo: Sandakan (Baker), including the male allotype.

IX.—Trigona fimbriata Smith

(Pl. II, fig. A; · Pl. IV, figs. P and P[1])

Trigona fimbriata SMITH, 1857, Journ. of Proc. Linn. Soc. Zool., II, p. 52.

Melipona fimbriata DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 578.

Trigona flavistigma CAMERON, 1902, Journal Straits Asiatic Society, XXXVII, p. 130 (variety).

Trigona flavistigma CAMERON, 1908, Entomologist, XLI, p. 192 (variety).

Trigona versicolor FRIESE, 1908, 'Nova Guinea' (l'Expéd. scient. néerlandaise sous A. Wichmann), V, Zoologie, p. 358, Pl. xv, fig 1 (variety).

Trigona anamitica FRIESE, 1917, 'Nova Guinea' (Expéd. sci. néerlandaise sous A. Wichmann), V, Zoologie, pp. 358–359 (variety).

Trigona melanotricha COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, pp. 386, 387 (variety).

Trigona fimbriata COCKERELL, 1919, Philippine Journal of Science, XIV, p. 79.

Trigona fimbriata COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241.

Trigona flavistigma COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241 (variety).

Trigona aliceae COCKERELL, 1929, Annals and Mag. Nat. Hist., (10), IV, pp. 139, 140 (variety).

Trigona ferrea COCKERELL, 1929, Annals and Mag. Nat. Hist., (10), IV, pp. 139–140 (variety).

Trigona fimbriata, which Smith described from Singapore, and *flavistigma*, which Cameron described from Kuching, Sarawak, are very closely related. Their principal difference resides in the coloration of the legs and of the abdomen. In *fimbriata*, the type of which I have seen, both middle and hind tibiae are deep reddish brown to black, as well as their respective metatarsi; in *flavistigma* merely the middle metatarsi and the hind tibiae and metatarsi are of this dark coloration, as I have had a chance to confirm through an examination of what seems to be the authentic type of *flavistigma*, bearing as it does the legend "Sarawak 1903.249" and "Kuching, Apl. 29, 1899." The specimens collected by Messrs. Hobby and Moore while on the Oxford University Sarawak (Borneo) Expedition more nearly approximate *fimbriata* than *flavistigma* in the coloration of the legs although the parts mentioned as deep reddish brown to black in *fimbriata* are more nearly completely black in these specimens. Moreover, they have the hind femora black and one of them has also the middle femora more or less black, a degree of melanism not shared by the type of *fimbriata*.

The abdomen of *fimbriata* is described as follows: "The two basal segments rufo-testaceous, their apical margins, as well as the whole of the following segments, nigrofuscous." Cockerell's key to the *Trigona* of the Malay region (1923, Annals and Mag. Nat. Hist., (9), XII, pp. 240–241) specifies that the first THREE abdominal segments are fulvous, with broad black margin, and this condition is suggested by the partly revealed third tergite of the type of *fimbriata*. Cameron's *flavistigma*, on the other hand, is rufo-testaceous with the base of the abdomen of lighter tint, and this condition is somewhat approximated by the specimens collected by Messrs. Hobby and Moore, which are for the most part dark red, with, in the case of one of them, darker rims.

These specimens thus occupy in some ways a middle ground between *fimbriata* and *flavistigma*, and it seems from these comments that we

are dealing in *fimbriata* with a species that is rather variable and that *flavistigma* is at most a not very clearly separable race of it.

This impression is further confirmed by the description of Friese's *versicolor* (1908, Nova Guinea, V, Zoologie, p. 358) part of the type material of which came from Borneo. The structure of the hind tibiae and hind metatarsi as described for *versicolor*, and for the most part the other characters given, apply so well to the specimens here interpreted as *fimbriata* as to leave little doubt that Friese's insect and the insects collected by Hobby and Moore are essentially the same, and the structural identity of the two is confirmed by a paratype of *versicolor* I have seen from Perak, Malacca, 1902 (Pl. IV, figs. P and P[1]). Friese's description of *versicolor* as respects the coloration of the abdomen reads: "Segments 1–4 mostly reddish yellow, 5–6 more blackish brown." This is the condition of the Perak paratype except that one might add that the apex, at least, of tergites 1–4 is likewise blackish brown. The legs of *versicolor* are described as "nearly black," but as regards the paratype from Perak this seems to me an overstatement, the legs being more extensively red than in the specimens here reported upon from Borneo.

Differentiating itself from *fimbriata*, *flavistigma*, and *versicolor* by its prevailingly black appearance is *melanotricha* Cockerell (1918, Annals and Mag. Nat. Hist., (9), II, p. 386), the type of which I have seen, but structurally this insect seems to me to ally itself with the others.

The opposite extreme to *melanotricha* is represented by *ferrea* from Mekami River, Siam. It is structurally like *fimbriata*, according with the plastic characters set down in the key to this paper, but it is even more extensively clear ferruginous than the other light-colored forms of the *fimbriata* complex. The middle basitarsi, as well as the hind tibiae and hind basitarsi are ferruginous, not black as in *flavistigma*, with the type of which I have compared the type of *ferrea*.

Trigona aliceae is in my estimation also to be considered a variety of *fimbriata*. It has been stated that the mandible of *aliceae* is different from that of *flavistigma*, which I believe to be structurally like *fimbriata*. I have compared the type of *aliceae* with the type of *flavistigma*. Both have a ferruginous mandible with "a broad rounded apical dusky cutting edge" but, in addition, each insect has two large black teeth of, it seems to me, identical shape and size, placed in the same relative position along the inner margin of the mandible (Pl. II, fig. A). The abdomen of *alicéae* has tergites 1–5 traversed, each near the middle, by a blackish

6. *Zool. Anzeiger* (Carus), I (1878), pp. 54, 55. Translation in *Proc. Ent. Soc. Lond.*, 1915, pp. xxii, xxiii.
7. *Proc. Zool. Soc.*, 1887, pp. 191-274.
8. *Ent. Record*, XIII, No. 2, 1901, pp. 75, 76.
9. Both published by The Macmillan Co., New York. On pp. 21-23 of both editions the discoverer and his son generously refer to my early recognition of counter-shading in certain insects, although without any thought of its far-reaching importance. The references given are to *Trans. Ent. Soc. Lond.*, 1887, p. 294, and 1888, pp. 595-7.
10. *Proc. Roy. Soc.*, B, Vol. 106, pp. 83-87, pl. 5, 1930.
11. "Natural Selection the Cause of Mimetic Resemblance and Common Warning Colours," *Linn. Soc. Journ.—Zool.*, XXVI, 558-612, pls. 40-44, 1898. Reprinted, revised, as VIII in "Essays on Evolution," Poulton, Oxford, 1908.
12. *Trans. Ent. Soc. Lond.*, 1902, Pt III, pp. 287-584, Pls IX to XXIII.
13. *Trans. Ent. Soc. Lond.*, 1909, Pt. 3, pp. 329-383.
14. *P.Z.S.*, 1902, pp. 230-284, coloured pls. XIX-XXIII.
15. *P.Z.S.*, 1912, pp. 358-376, coloured pl. XLVIII.
16. *Trans. R. Ent. Soc*, *83*, Pt. 1 (June 1935), pp. 11-22, pl. II.
17. *Proc. Acad. Nat. Sci. Phila.*, 1912, pp. 281-364.
18. *Smithsonian Miscellaneous Collections*, Vol. 85, No. 7, 1932, pp. 1-201.
19. *Proc. V. Congr. Internat. Entom., Paris*, 1932, pp. 33-44.
20. *Trans. Roy. Ent. Soc., Lond.*, Vol. 80, Pt II (December 1932), pp. 345-385, pls. XVIII-XXVIII.
21. *Trans. Roy. Ent. Soc. Lond.*, Vol. 82, Pt II (December 1934), pp 443-453, pls. XVI, XVII.
22. "Bijdrage tot de Biologie en de Ecologie van den Spreeuw (*Sturnus vulgaris vulgaris* L.) gedurende Zijn voortplantingstijd." Published as "Verslagen en Mededeelingen van den Plantenziektenkundigen Dienst te Wageningen," No. 69, 146 pp., Wageningen, Jun. 1933. An abstract of the results of this paper appears in *Proc. Roy. Ent. Soc.*, Vol. VIII (1933-4), pp. 160, 161, 170-172.
23. *Trans. R. Ent. Soc. Lond.*, 85, pt. 5 (May 1936), pp. 131-139, pls. 1-3
24. *Ecology*, Vol. 19, No. 3, July 1938, pp. 370-389

band that gives the otherwise largely reddish abdomen a distinctive appearance.

Trigona anamitica Friese, judging from the description, appears also to be a close relative.

Specimens of the *fimbriata* complex collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, Dulit Trail, in "primitive forest," Aug. 16, 1932, one worker; R. Kapah, trib. of R. Tinjar, on "clearing," Oct. 6, 1932, one worker.

In the British Museum are other specimens from Sarawak that approximate the condition of *flavistigma*. These were collected at Lundu, Jan. 6, 1914, and at Mt. Matang, Jan. 25, 1914, by G. E. Bryant.

X.—**Trigona scintillans** Cockerell

(Pl VII, fig. X)

Trigona scintillans COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116

Trigona scintillans COCKERELL, 1929, Annals and Mag Nat. Hist., (10), IV, p. 590

This distinctive little insect, originally described from Borneo and subsequently reported by Cockerell also from northern Siam, "where they were a great nuisance in camp, settling on one's hands and face," is not represented in the collection of the Oxford University Sarawak (Borneo) Expedition.

XI.—**Trigona canifrons** Smith

(Pl. II, fig. C; Pl. V, fig. Q)

Trigona canifrons SMITH, 1857, Journ. of Proc. Linn. Soc. Zool., II, p. 51.

Melipona canifrons DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 576.

?*Melipona canifrons* BINGHAM, 1897, 'Fauna of British India -Hymenoptera,' I, pp. 560, 562.

?*Trigona canifrons* COCKERELL, 1905, Annals and Mag. Nat Hist., (7), XVI, p. 220.

?*Trigona laeviceps* SCHULZ, 1907, Zeitschr. wiss. Insektenbiol., III, pp. 65–73 (nest from Java). (See Zeitschr. wiss. Insektenbiol., 1909, V, p. 341.)

Trigona canifrons CAMERON, 1908, Entomologist, XLI, pp. 192, 194.

?*Trigona canifrons* SCHULZ, 1909, Zeitschr. wiss. Insektenbiol., V, pp. 338–341 (nest from Java).

?*Trigona canifrons* COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 385.

Trigona busara COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387.

?*Trigona canifrons* COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 244.

Trigona busara COCKERELL, 1919, Philippine Journal of Science, XIV, pp. 78, 79.

Trigona canifrons COCKERELL, 1923, Annals and Mag. Nat. Hist. (9), XII, pp. 241, 242.

Trigona canifrons FRIESE, 1933, Naturh. Maandblad, XXII, p. 46.

Some of the more salient characters of *canifrons*, based on the specimen in the Wilson Saunders collection at Oxford, are set down in the key. Smith in his original description recorded the length as 2 1/2 lines but remeasurement of the specimen at Oxford reveals the length as slightly more than 7 mm. I have not seen the type of *busara* Cockerell but a specimen from Singapore, collected by Baker and designated *busara* by Cockerell,[1] is in my estimation scarcely separable from *canifrons*. Smith's type of *canifrons* keys out to *busara* in Cockerell's keys (1918, Annals and Mag. Nat. Hist., (9), II, p. 387; 1919, Philippine Journal of Science, XIV, p. 78).

Trigona canifrons is not represented in the catch of the Oxford University Sarawak (Borneo) Expedition.

XII. **Trigona iridipennis** Smith

(Pl. III, fig. H; Pl. IV, fig. O)

Trigona iridipennis SMITH, 1854, Catal. Hymen. Brit. Mus., II, p. 413.

Trigona praeterita WALKER, 1860, Annals and Mag. Nat. Hist., (3), V, p. 305.

Melipona iridipennis DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 579.

Melipona praeterita WALKER, 1896, 'Catalogus Hymenopterorum,' X, p. 582

Melipona iridipennis BINGHAM, 1897, 'Fauna of British India Hymenoptera,' I, pp. 560–561, 563–564.

?*Melipona praeterita* BINGHAM, 1897, 'Fauna of British India--Hymenoptera,' I, pp. 560–561, 564.

Trigona bengalensis CAMERON, 1896, Memoirs and Proc. Manchester Lit. and Phil. Soc., XLI, pp. 143–144.

Trigona iridipennis COCKERELL, 1919, Philippine Journal of Science, XIV, p. 79.

Trigona iridipennis COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 242.

?*Trigona laeviceps* COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241.

Trigona iridipennis COCKERELL, 1929, Annals and Mag. Nat. Hist., (10), IV, pp. 590, 592.

Trigona iridipennis FRIESE, 1933, Naturh. Maandblad, XXII, p. 46.

Melipona irridipennis GEORGE, 1933, Journal of University of Bombay, I, Pt. 5, pp. 58–61 (bionomics, morphology, and metamorphosis).

Melipona irridipennis GEORGE, 1934, Journal of University of Bombay, II, Pt. 5, pp. 1–16 (excretion during metamorphosis).

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[1] Very possibly this is the specimen of *busara* collected by Baker at Singapore which figures in Cockerell's key (1919, Philippine Journal of Science, XIV, p. 78).

A series in the U. S. National Museum from Buitenzorg, Java, identified by Crawford as *iridipennis*, has the hairs on vertex pale and those on mesonotum and scutellum likewise exclusively pale, in these respects differing from the type of *iridipennis* and from the Borneo specimens here considered (see specifications in key under 15).

Cockerell differentiated *valdezi* and *penangensis* from *iridipennis* by the dusky wings, but the type of *valdezi* seems to me to have wings of approximately the same clarity as those in the Bornean specimens here referred to *iridipennis*. *Trigona valdezi* as represented by the type is a slightly larger insect than what I interpret as *iridipennis*, but shares with *iridipennis* the merely vestigial malar space, approximately flat clypeus, black hairs on vertex and a few dark hairs intermixed with the light on the mesonotum and scutellum.

Walker's *praeterita* (1860, Annals and Mag. Nat. Hist., (3), V, p. 305) is represented by a type in the British Museum to which Walker's description applies except as to size, his type being only about 3 mm. whereas the description calls for a larger insect, 2 1/2 lines in length. If the type be authentic, *praeterita* is, in my estimation, a synonym of *iridipennis*, with the type of which I have compared it. Both insects were described from Ceylon and the distinctions that Bingham draws in his key (1897, 'Fauna of British India—Hymenoptera,' I, pp. 560–561) are not sustained by the types of *iridipennis* and *praeterita*, both of which have the smaller joints of the tarsi of all the legs ferruginous. Bingham said of *praeterita* (p. 564): "I am not quite certain whether I have rightly identified this species."

Cockerell (1929, Annals and Mag. Nat. Hist., (10), IV, p. 590) found *iridipennis* "common at flowers of *Helianthus annuus*" in Rangoon, Burma, on Dec. 15. More recently I have received specimens obtained in Malaya by Mr. James A. Baker, who reports their "frequent attendance on the infloresccnces of the aroid *Homalomena sagittifolia*."

Specimens of *iridipennis* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, Dulit Trail, "primitive forest," Aug. 16, 1932, three workers; foot of Mt. Dulit, junction of rivers Tinjar and Lejok, "cultivated land now waste," Aug. 22, 1932, one worker; Mt. Dulit, R. Lejok, "near sweat and water," Oct. 5, 1932, three workers.

The specimens collected by Messrs. Hobby and Moore that are here assigned to *iridipennis* have the flagellum rather dark above and cloudy even below in contrast to the ferruginous scape, which is tipped with black only at the apex behind. According to Smith's description the

antennae are "pale testaceous" but his type specimen is testaceous only below, being black above, and this is the condition of another specimen from the type locality (Ceylon) identified by Friese as *iridipennis*. Friese (1933, Naturh. Maandblad, XXII, p. 46) has reported *iridipennis* from Borneo.

XII A.—? **Trigona erythrostoma** Cameron

Trigona erythrostoma CAMERON, 1908, The Entomologist, XLI, pp. 192–193.

Trigona erythrostoma COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 386.

Trigona erythrostoma COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

The specimens that have been assigned to the type material of *erythrostoma* in the British Museum, although all from Kuching, the type locality, are, in my estimation, probably not the specimens on which Cameron based his description. Two of them are *fusco-balteata* and depart rather decidedly from the specifications for *erythrostoma*. On the other hand, even the third specimen does not fit Cameron's description by any means perfectly. The nervures and stigma of *erythrostoma* are described by Cameron as black and Cockerell in his paper of 1920 refers to the stigma as black, but the specimen labeled type has both the venation and the stigma dull brown, and does not fully correspond in respect to the distribution of the dark hairs and the light hairs with Cameron's specifications. The specimen in any event comes very close to *iridipennis* Smith, the type of which I have seen. It runs to that species in the key prepared for this paper.

XIII.—**Trigona fusco-balteata** Cameron

Trigona fusco-balteata CAMERON, 1908, The Entomologist, XLI, pp. 192–193, 194, 195.

Trigona pygmaea FRIESE, 1933, Naturh. Maandblad, XXII, p. 147.

There are two specimens of *fusco-balteata* in the British Museum, both with type labels and bearing the legend, "Medang, July 1902." Medang, in Sarawak, Borneo, is the type locality specified in Cameron's description. Friese's *pygmaea* from Sumatra, of which I have seen paratypes, is scarcely to be differentiated from *fusco-balteata* and I am inclined to regard it as a synonym. Friese (1933, Naturh. Maandblad, XXII, p. 147) like Cameron mentions the variability in the depth oi the abdominal coloration, raising the question in connection with the specimens of more faded banding whether they do not represent a callow condition. The type of *atomella* Cockerell is in the U. S. National

Museum and the type of *fusco-balteata* is in the British Museum. An actual comparison of the types was, therefore, not feasible, but a specimen from Siam identified by Cockerell as *atomella* is exceedingly like *fusco-balteata*, differing mainly in the darker coloration of the abdomen, although even *atomella* has the venter of the abdomen more or less pale.

There are no specimens assignable to *fusco-balteata* among the specimens obtained by the Oxford University Sarawak (Borneo) Expedition.

XIV.—**Trigona atomella** Cockerell

Trigona atomella COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, pp 243–244.

Trigona atomella COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p 116.

Trigona atomella COCKERELL, 1929, Annals and Mag. Nat. Hist., (10), IV, p. 590.

Trigona atomella, which is possibly rather to be considered a variety of *fusco-balteata* than an independent species, was described from the Island of Penang and subsequently recorded from various localities in Siam. A series in the U. S. National Museum from Sandakan, Borneo (Baker) is, in my estimation, also ascribable to *atomella.*

XV.—**Trigona rufibasalis** Cockerell

Trigona rufibasalis COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p 387.

Trigona rufibasalis COCKERELL variety *a*, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

This species, the type of which I have seen, is represented by a single specimen in the collection of the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, 4000 ft., moss forest, Oct. 18, 1932, one worker.

XVI.—**Trigona confusella** Cockerell

Trigona geissleri FRIESE (specimens from Sintang, Borneo, thus named by Friese but presumably never described).

Trigona geissleri COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, pp. 385–386, 387.

?*Trigona geissleri* var. *a*, COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 242.

Trigona confusella COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 242.

In 1918 Cockerell examined a male from Sintang, north Borneo, and a couple of workers from Singapore. The Bornean male had the flagellum black; in the Singapore workers the flagellum was "ferruginous, more or less dusky above." Cockerell assigned the specimens from both localities to *geissleri* Friese, commenting, however, to the effect that "the Singapore insect should perhaps be separated but we should first see Bornean workers." In 1919, Cockerell erected his *confusella* on the basis of these Singapore workers previously assigned to *geissleri*. A paratype (worker) of *geissleri* Friese, bearing the label "Sintang 1909," has been compared with *confusella* and the slight differences noted by Cockerell between the male from Sintang and the workers from Singapore does not obtain, judging from this paratype, between workers from Sintang and workers from Singapore. It is true there is some difference in the depth of tone of the tomentum on the scutellum: that of the Sintang worker (*geissleri*) being fulvous, while that of the Singapore worker (*confusella*) is blackish (in both the Sintang worker and the Singapore worker the erect hairs, as distinguished from the tomentum, on the scutellum are black). However, as the specimens collected by the Oxford University Expedition to Borneo have this tomentum blackish, it is evidently a very unstable character and one on which a separation of the insects cannot well be based. I also note some variability in the coloration of the erect hairs on the outer side of the middle tibiae. In the specimens taken by the Oxford University Expedition to Borneo these seem to be pure black, in the paratype of *geissleri* silvery gray, in *confusella* gray apically and more blackish basally. However, the middle tibiae in these several specimens (exclusive of the paratype of *geissleri*) are rather clogged with foreign material and this may have contributed to the dark appearance of their hairs. One character that seemed to me at first to separate the Oxford University Expedition specimens from the type material of Cockerell and of Friese was the more heavily punctate tegulae of the specimens of the Oxford University Expedition. However, I have come to the conclusion that the roughened character of the surface of the tegulae is illusory rather than real, due, I believe, to the fact that the dense hairs covering the tegulae in these specimens are sticky and massed, producing a rugose appearance. To some extent this is the condition on one of the tegulae also of the paratype of *geissleri* while the other tegula, on which the hairs are less massed, has at least a dull sheen.

Cockerell could not locate a description of *geissleri* and I, too, have failed to trace a description of it by Friese. If such a description exists,

the specimens taken by the Oxford University Expedition to Borneo should be designated *geissleri* Friese but in the absence of such a description they bear the name *confusella* Cockerell.

Specimens of *confusella* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: foot of Mt. Dulit, junction of rivers Tinjar and Lejok, on "cultivated land now waste," Aug. 22, 1932.

XVII.—**Trigona sarawakensis**, new species

(Pl. II, fig. E; Pl. IV, fig. M and M[1])

WORKER. Smooth and sculptureless. Head and thorax predominantly black, the tegulae clear ferruginous, the legs almost wholly ferruginous, the abdomen usually rather uniformly ferruginous, sometimes darkened on the apical segments.

The head smooth and polished, broader than long and extending somewhat beyond the outer rims of the tegulae; eyes slightly convergent below; malar space vestigial, the base of the mandible almost in contact with the rim of the eye, separated from it by only a hair's width; mandibles with their apex curvilinear in profile, the outer three-fifths edentate, the inner two-fifths with two teeth, of which the first and much the smaller tooth is in close proximity to the edentate part, the second and notably larger tooth is emphatically separated and springs from a somewhat lower level than its companion (Pl. II, fig. E); apico-lateral corners of rather flat clypeus in close approximation to the eye; the anterior ocellus rather more sunken than the lateral ocelli, which, placed somewhat slantwise, seem slightly protuberant in contrast. The clypeus, sides of face, and front covered with minute appressed silvery hairs; no erect bristles on clypeus, sides of face, or scape; a very few fine erect hairs on the front just below the ocelli and on the vertex, labrum, and fringing the mandibles below. The head black but the clypeus more or less suffused with red and the supraclypeus dull red; the mandibles, except for their black basal prominences and dull red to black apical edge and teeth, ferruginous as are the labrum, scape (except for a little sootiness posteriorly at the apex) and flagellum below.

The thorax semi-shiny and predominantly black, with the tubercles and prothorax somewhat invaded by ferruginous and the tegulae bright ferruginous. Erect, pale hairs on mesonotum, scutellum, and mesopleura in addition to silvery tomentum, which is especially dense on the sides of the metathorax and somewhat less dense on the mesopleura. A very deep fossa separating the mesonotum from the scutellum; the latter extended backward, somewhat over-roofing the bare and highly shiny propodeum.

The legs predominantly ferruginous, the front and middle tibiae briefly tipped with black at the apex, the femora sometimes similarly blackened at the apex, and the middle and hind metatarsi usually darkened. The hairs of the legs pale to ferruginous, those on the under side of the coxae and trochanters relatively long and pale in contrast to the much shorter and sparser hairs of the femora; the middle tibiae more conspicuously hairy, especially on their under surface, than the fore tibiae, on which the hairs are for the most part minute; the hind tibiae fringed anteriorly with

pale bristles and posteriorly with rather short, finely plumose pale hairs that overlie a much thinner fringe of simple pale hairs; over the basal half of the external face of the hind tibiae are erect pale to yellowish hairs. The anterior contour of the hind tibiae slightly concave at the base but approximately straight beyond; the posterior contour convex with the result that the joint is widened gradually toward the apex, which is rounded behind at the tip and subtruncate to very slightly emarginate along its apical edge (Pl. IV, fig. M). The hind metatarsi narrowed very slightly toward the base, their under side with a suboval, bristleless, differentiated area at the base (Pl. IV, fig. M[1]).

The wings are hyaline, slightly tinged with yellow, their venation and stigma rather bright ferruginous like the tegulae.

The abdomen about as wide as the thorax, rather plump, not in the least flattened, as a rule rather uniformly ferruginous (but in one specimen decidedly darkened on the three apical segments), and the three basal tergites virtually hairless (a few inconspicuous hairs apically on tergites 2 and 3) and very shiny, the three apical tergites with a few pale to ferruginous erect hairs, somewhat denser on tergite 6 than on either tergites 5 or 4, and appressed pale hairs also on tergite 6. The venter with pale hairs down the middle grading into silvery sericeous patches to each side.

Length 3 1/2 to 4 mm.; width of thorax 1 1/2 mm.; length of forewing, 4 1/2 to 5 mm.

This species is possibly close to Smith's *laeviceps*, the abdomen of which is described as "castaneorufo" in the abbreviated description in Latin and as "ferruginous" in the more expanded description in English (Smith, 1857, Journ. Proc. Linn. Soc. Zool., II, p. 51). There is no mention in Smith's description of the color of the tegulae and of the legs but, in view of the fact that in the brief summary in Latin the insect is described as "nigra," it is likely that the legs and tegulae were black in *laeviceps* in contrast to the condition in *sarawakensis*, which has mainly ferruginous legs and tegulae. A dark condition of the legs characterizes a specimen in the U. S. National Museum collected by Fea in May, 1885, at Rangoon, which Cockerell (1929, Annals and Mag. Nat. Hist., (10), IV, p. 590) interpreted as identical with *laeviceps* as described by Smith. This Rangoon specimen identified as *laeviceps* is identical in such measurements as the width of the head and the length of the hind tibiae with specimens of *iridipennis* from various localities, including those collected on Mt. Dulit. The specimens designated *sarawakensis* are, on the other hand, larger than *iridipennis* in respect to these parts as well as having somewhat greater body length.

Smith's type of *laeviceps* is no longer in existence. As Cockerell has pointed out (1929, Annals and Mag. Nat. Hist., (10), IV, p. 590), what is designated the type of *laeviceps* in the Oxford University Museum has the locality label "Aru," not "Singapore" from which *laeviceps* was described, and it is an insect of dark abdomen. It is, I think, un-

doubtedly the specimen that Smith recorded from Aru two years after describing *laeviceps* (Smith, 1859, Journ. Linn. Soc. Zool., III, p. 135).

Specimens of *sarawakensis* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, 4000 ft., in "moss forest," Oct. 18, 1932, two workers; Oct. 19, 1932, two workers; Oct. 22, 1932, one worker (the specimen with darker apical segments of abdomen), and with the additional field note "at waterfall."

XVIII.—**Trigona melanocephala** Gribodo

Trigona melanocephala GRIBODO, 1893, Bullet. Soc. Entom. Italiana, XXV, p. 264.

Trigona testaceinerva CAMERON, 1908, The Entomologist, XLI, p. 195.

Trigona melanocephala COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 242.

In some of the specimens of the rather large series before me the mesonotum is more or less darkened in addition to the head (exclusive of the honey-colored clypeus, supraclypeal triangle, labrum, scape, and flagellum beneath). The legs, too, sometimes have a few somewhat darkened areas, especially the posterior half of the hind tibiae and hind basitarsi; even the abdomen is in rare cases more or less brownish.

Gribodo regarded *melanocephala*, the type of which I have not seen, as perhaps only a conspicuous variety of his *melina*. The malar space seems just a trifle less obsolete in what is here interpreted as *melina* than in *melanocephala*, but perhaps the insignificant difference is relatively no greater than that between the sizes of the two insects. Due to the fact that it has black areas on the head, *melanocephala* bears about the same relation to *melina* that, among the New World species, *pallida* variety *ferricauda* bears to typical *pallida*.

The type of *testaceinerva* Cameron from Kuching in the British Museum unfortunately lacks a head, in which the characters most diagnostic for this species reside, but in other respects the insect seems to be in accord with what I have interpreted as *melanocephala*.

Specimens of *melanocephala* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, Dulit Trail, primitive forest, Aug. 16, 1932, two workers; foot of Mt. Dulit, junction of rivers Tinjar and Lejok, "light traps 5," Sept. 24, 1932, seven workers; Mt. Dulit, R. Lejok, "near sweat and water," Oct. 5, 1932, five workers; Mt Dulit, 4000 ft., moss forest, Oct. 19, 1932, one worker.

XIX.—**Trigona pallidistigma** Cameron

Trigona pallidistigma Cameron, 1908, The Entomologist, XLI, pp. 192–193, 195.

This little bee, the type of which I have seen, is a dwarf among the other bees of mainly ferruginous coloration such as *melina* and *melanocephala*, and on this basis alone is readily separable from them. The relationship, however, of not merely *melina*, *melanocephala*, *sarawakensis*, and *pallidistigma* but also of *iridipennis*, *fusco-balteata*, and *atomella* is structurally very close. In fact, the present insect is possibly merely a pale variety of *fusco-balteata*, with which it agrees in size.

The type of *pallidistigma* seems to be authentic. The label gives the locality as Borneo and the collector as "147 Shelf.," which undoubtedly stands for R. Shelford; both of these designations are in accord with the corresponding data given in the description.

XX.—**Trigona melina** Gribodo

Trigona melina Gribodo, 1893, Bullet Soc. Entom. Italiana, XXV, pp. 262–263.

Trigona melina Friese, 1908, 'Nova Guinea' (Expéd. sci. néerlandaise sous A. Wichmann), V, Zoologie, p. 357.

Although I have not seen the type of *melina*, which Gribodo described from Borneo, the specimens collected by Messrs. Hobby and Moore correspond so well with Gribodo's specifications that there can be little doubt that they belong to that species. They are slightly smaller (about 4 1/2 mm.) than the measurement (5 mm.) recorded by Gribodo, thus tending to bridge the contrast in size which Gribodo reported to exist between his *melina* and his *melanocephala;* but this trifling disparity may be accounted for by the degree of telescoping of the abdomen in individual specimens. The extent of the darkening of the apical segments of the abdomen to which Gribodo called attention is somewhat variable even in the little series before me, ranging from a condition where there is hardly any deepening of tint to one where not merely the apical segments but the basal as well are deep brownish.

Specimens of *melina* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Mt. Dulit, Dulit Trail, primitive forest, Aug. 16, 1932, one worker; Mt. Dulit, R. Lejok, "near sweat and water," Oct. 5, 1932, two workers (including the specimen with dark abdomen); Mt. Dulit, R. Koyan, 2500 feet, undergrowth, primitive forest, Nov. 17, 1932, one worker.

XXI.—**Trigona thoracica** variety **lacteifasciata** (Cameron)

(Pl. III, fig. J; Pl. VII, fig. W)

Trigona lacteifasciata CAMERON, 1902, Journal Straits Asiatic Soc., XXXVII, p. 131.

Trigona lacteifasciata CAMERON, 1908, Entomologist, XLI, pp. 192–193.

Trigona lacteifasciata COCKERELL, 1919, Philippine Journal of Science, XIV, p. 78.

Trigona lacteifasciata COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 242.

In *thoracica* Smith (1857, Journ. Proc. Linn. Soc. Zool., II, p. 50), *lacteifasciata* Cameron (1902, Journal Straits Asiatic Soc., XXXVII, p. 131), *ambusta* Cockerell (1919, Philippine Journal of Science, XIV, p. 78), and *bornеënsis* Friese (1933, Naturh. Maandblad, XXII, p. 46) we have four insects that are structurally alike. The resemblances and differences are tabulated (p. 318) on basis of the several descriptions and an examination of the types of *thoracica*, *lacteifasciata*, and *ambusta*, and of paratypes of *bornеënsis;* also there have been tabulated the corresponding characters of the single representative of this complex collected by the Oxford University Sarawak (Borneo) Expedition. The comments in parenthesis are based on an examination of the type material.

Trigona thoracica, according to Bingham's key (1897, 'Fauna of British India—Hymenoptera I,' pp. 560–561) has "Head, thorax and abdomen black, a square mark on mesonotum rufo-testaceous," but Smith indicated that the thorax is "obscurely ferruginous," which I have substantiated by an examination of the type. Nevertheless, *thoracica* is a darker form, with mainly blackish abdomen, than the variants from Borneo. Its measurement, 7 mm., is deceptive, its small size compared with the insular variants being ascribable to the telescoping of the apical tergites, not to lack of robustness.

Trigona ambusta, like *thoracica* described from Singapore, is also of darker appearance than the Borneo forms, for it has mainly black legs and a mainly blackish abdomen, which is the condition also in a specimen from Kuala Kubu, Malacca, collected in March, 1912, by Buttel-Reepen.

The members of this complex extend also into Sumatra, represented in the British Museum by a specimen collected at Deli by Dr. Martin. It is possibly a callow, having rather pale hind tibiae.

The following specimen collected by the Oxford University Sarawak (Borneo) Expedition:

thoracica Smith (from Singapore)	*lacteifasciata* Cameron (from Borneo)	*ambusta* Cockerell (from Singapore)	*borneensis* Friese (from Borneo)	*Oxford Exped specimen* (from Borneo)
Scape red at base (approximately the basal half)	Scape rufous on basal two-thirds	Basal third of scape bright ferruginous	(In paratypes scape is fulvous in front on basal half to two-thirds)	Scape fulvous on basal two-thirds
Clypeus red (with a wide frame of black. Supraclypeus also red)	Clypeus broadly rufous in center (almost completely so, being dusky only near edges). Supraclypeus also rufous	Clypeus ferruginous, broadly suffused with dusky above and at sides. (Supraclypeus ferruginous)	Clypeus yellowish brown (also supraclypeus in all paratypes examined)	Clypeus and supraclypeus largely fulvous, blackish around edges
Mandibles red at base	Mandibles black	Mandibles blackish	Mandibles yellowish brown at base (the mandibles range in paratypes from deep red to black)	Mandibles black
Thorax obscurely ferruginous	Thorax dark rufous	Mesothorax and scutellum ferruginous, the latter with two dark marks and mesothorax with dusky lines	Thorax reddish brown	Thorax fulvous
Legs ferruginous at base. (More or less reddish also on femora, tibiae, and tarsi)	Coxae, trochanters, and femora dark rufous. (In the specimen designated type they seem rather to be bright red)	Like *lacteifasciata* but femora black (more especially the middle and hind pair, the fore pair being red beneath)	Legs reddish brown but tibiae and tarsi of II and III black. (Also black in the paratypes are front basitarsi, and there are black stripes on under side of femora III and more feebly on under side of femora II)	Legs fulvous but tibiae and tarsi (except apical joint) of II and III black, and black stripes on under side of middle and hind femora
Abdomen pale testaceous at base (in basal concavity)	(The first two tergites a rather bright red; the others dull, clouded red)	Abdomen black, extreme base of first segment red	Abdomen reddish brown; segments 5–6 yellowish brown. (Apical rims of tergites of paratypes, especially tergites 2–4, paler than base)	Abdomen fulvous to reddish; the apical half of the tergites somewhat darkened
Length 3 1/2 lines	Length 8–9 mm.	Length 8.5 mm.	Length 8–9 mm.	Length 8–9 mm.

Sarawak: foot of Mt. Dulit, junction of rivers Tinjar and Lejok, on "cultivated land now waste," Aug. 22, 1932.

XXII.—**Trigona erythrogastra** Cameron
(Pl. III, fig. K; Pl. VI, fig. V)

Trigona erythrogastra CAMERON, 1902, Journal Straits Asiatic Soc., XXXVII pp. 129–130.

Trigona erythrogaster CAMERON, 1908, Entomologist, XLI, pp. 193, 194.

Trigona luteiventris FRIESE, 1917, 'Nova Guinea' (Expéd. sci. néerlandaise sous A. Wichmann), Zoologie, V, p. 358 (variety).

Trigona sandacana COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, pp. 242–243 (synonym of *luteiventris*).

Trigona erythrogaster COCKERELL, 1920, Annals and Mag. Nat. Hist, (9), V, p. 115.

Trigona erythrogastra COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 242.

Trigona erythrogastra, the type of which I have examined,[1] has the three apical tergites of the abdomen black and black areas even on tergites 2-3 whereas *luteiventris* Friese, of which I have seen a metatype from Gap Selang., Malacca, collected by Buttel-Reepen in March, 1912, has all of the tergites of the abdomen, and the sternites as well, red. Nevertheless, I am inclined to believe *luteiventris* at most a variety of *erythrogastra,* for the two insects agree structurally in all essential respects. I have also seen the type of Cockerell's *sandacana* and believe this, too, cannot well be separated. It approximates *luteiventris* in the coloration of the abdomen, and it is likely that a completely red abdomen is the more usual condition in this species rather than one partly black. The clypeus of both *erythrogastra* and *luteiventris* is covered with a fine down or pile that at first glance seems to be absent from the clypeus of *sandacana,* but, when *sandacana* is viewed from the side, such hairs are also traceable on its clypeus although in less abundance, possibly due to wear.

Friese has called attention to the superficial resemblance between his *luteiventris* and the Neotropical *fulviventris,* but fundamentally the insects are very different, *fulviventris* having a quadridentate mandible, whereas *erythrogastra, luteiventris,* and *sandacana* are unusual in having only a single, merely moderately developed tooth toward the inner edge of the apex of the mandible (Pl. III, fig. K). This rather unusual type of mandible is approximated also by *itama* (Pl. III, fig. L). The unidentate mandible of the New World *Trigona capitata* and

[1] The specimen marked type is undoubtedly authentic, both the collecting site (Sarawak and the collector's name (Shelford) being in agreement on the label and in the description.

its varieties has, in contrast, the tooth at its inner extremity very prominent.

Trigona flaviventris Friese, described from New Guinea, is superficially much like *luteiventris*, having a reddish abdomen that contrasts with the black head and thorax, but *flaviventris* is readily separable by the presence of two teeth on the inner one-third of the mandible and by its somewhat shorter malar space. If one may judge from a metatype of *flaviventris*, this species shares with *canifrons* the distinction of having the middle region of the propodeum hairy.

XXIII.—**Trigona haematoptera** variety **haematoptera** Cockerell

Trigona haematoptera Cockerell, 1919, Annals and Mag. Nat. Hist., (9), III, p. 243.

Trigona haematoptera, the type of which I have seen, resembles *fimbriata* and its varieties in the peculiarly strong dentition of the mandible. At first glance it might perhaps be mistaken for *fimbriata* variety *melanotricha*, the black bristles on the clypeus and the black hairs on the thorax and legs—common to both insects— intensifying the resemblance due to similar size and coloration, but *haematoptera* is structurally distinct by having a malar space almost twice as great as that of *melanotricha*, a less expanded hind tibia than *melanotricha*, and a differentiated bristleless area at the base of the inner surface of the hind metatarsi, which does not find place in *melanotricha* (see characters given for *fimbriata* in the key to this paper).

The typical variety of *haematoptera* is not represented among the specimens collected by the Oxford University Sandakan (Borneo) Expedition.

XXIV.—**Trigona haematoptera** variety **dulitae**, new variety

(Pl. II, fig. B; Pl. VI, fig. T)

Among the specimens collected by Messrs. Hobby and Moore is a large series identical in structure with *haematoptera*, which was described from Sandakan, Borneo (Cockerell, 1919, Annals and Mag. Nat. Hist., (9), III, p. 243). The specimens of this series differ from the type of *haematoptera*, which I have seen, by the color of the abdomen and by other characters noted under 24 in the key published in this paper.

It is not likely that the specimens with castaneous abdomen, here erected as the variety *dulitae*, are callows, for they do not evidence any other earmarks of a callow condition, and even the specimen collected at 1800 ft. in primitive forest on Mt. Kalulong by Mr. A. W. Moore

shares the castaneous abdomen and other characters with the specimens obtained at the foot of Mt. Dulit.

Variability as to the color of the abdomen has been pointed out in connection with other species discussed in this paper. It seems not improbable that a partly or wholly castaneous abdomen rather than a purely black abdomen is the more usual condition in *haematoptera.*

Specimens of *haematoptera* variety *dulitae* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: Foot of Mt. Dulit, junction of rivers Tinjar and Lejok, "nesting in dead tree," Aug. 2, 1932, two workers, and "flying round nest on large tree," Aug. 3, 1932, ten workers; Mt. Kalulong, 1800 ft., "undergrowth in primitive forest," Nov. 4, 1932, one worker.

XXV.—**Trigona moorei**, new species

(Pl. III, fig. G; Pl. IV, fig. N)

WORKER. Small, shiny, almost wholly black (whitish maculation at apex of tergites 1 and 6) with partly black, partly silvery gray hairs.

The head somewhat broader than long, extending a little beyond the outer rims of the tegulae; the eyes somewhat convergent below; the malar space long, only a little shorter than the mandible is wide at the base; the apical contour of the mandible somewhat curvilinear, its outer three-fifths edentate, its inner two-fifths with two denticles (Pl. III, fig. G); the clypeus distinctly flat, about twice as broad as it is long, broadly truncate along its apex, with only a very slight recession toward the eye at each end of the apex, the apico-lateral angles of the clypeus separated from the rim of the eye by more than the width of the flagellum; the ocelli almost in a straight line, the lateral ones oblique in position and raised a little above the level of the area intervening between their outer rims and the compound eyes Dull reddish are: approximately the apical one-third of the clypeus in the form of a not very clearly outlined transverse stripe, the labrum, the mandibles except for the black apex and black basal prominences; ferruginous are: the antennal sockets and the adjoining area at the base of the scape, the rest of the scape and the flagellum, even below, being black. The head smooth and shining, that part of it extending downward from the ocelli to the apex of the clypeus being devoid of erect hairs but covered, rather more densely and conspicuously on its lower half than on its upper half, with appressed, rather scalelike, ultramicroscopic silvery gray hairs; similar hairs on the genae; especially fine, stunted down on the scape—much finer even than the microscopic tomentum on the face; the vertex with rather coarse black bristles; pale hairs fringe the inferior margin of the mandibles, the labrum, and the lower part of the genae.

A few short black bristles along the anterior margin of the otherwise rather bare and distinctly shiny black mesonotum; scutellum also very shiny but with considerably longer black bristles, especially posteriorly. The mesopleura with silvery gray tomentum and concolorous erect hairs, the area to each side of the bare shiny middle portion of the propodeum with dense silvery gray tomentum.

The legs black except for the more or less ferruginous to deeper red tarsal joints.

The hair on at least the under side of the coxae and trochanters and on the fore femora beneath silvery gray, the hairs on the tarsal joints more or less yellowish, metatarsal brushes copper-colored to darker. With these exceptions the hairs are black: very minute and downslanting on the outer surface of the front tibiae; denser, somewhat longer and erect, with some plumose hairs intermixed, on the outer side of the middle tibiae; a thin fringe of simple hairs along the anterior contour of the hind tibiae and a much denser fringe of mainly plumose hairs along the posterior contour, both simple and plumose hairs on the basal half of the outer surface of the joint. The hind tibiae gradually widened from base to apex, their anterior contour concave, their posterior contour convex, the outer face of the joint depressed on its apical half, the apex itself rounded on its anterior half (but with a cleft where the comb is attached), subemarginate on its posterior half (Pl. IV, fig N). The hind basitarsi one-half to two-thirds the width of the hind tibiae, slightly contracted toward the base, their inner face with a differentiated, flat, bristleless area at the base contrasting with the rather brush-like arrangement of the bristles on the more apical part of the inner face

Wings hyaline, iridescent, with darkish venation and stigma. The tegulae black.

The abdomen comparable in breadth with the thorax, its tergites rather fully revealed (not telescoped), shiny black, with a narrow ivory-colored to faintly yellowish, transverse stripe at the apex of tergite 1 and the apical tip of tergite 6 likewise ivory-colored. Tergites 3–4 (to a slight extent also 2) very delicately and narrowly tessellated along their apical rims, with ultramicroscopic appressed hairs in the tessellated areas; at each of the lateral extremities of these tergites a few rather large punctures basad to the tessellation; tergite 5 with not merely appressed but minute erect black hairs narrowly along the apex; tergite 6 with such erect black hairs over most of its exposed surface. The venter with silvery gray erect hairs down the middle that grade into concolorous sericeous patches to each side.

Length 3 1/4 to 3 1/2 mm.; width of thorax about 1 1/4 mm.; length of forewing about 3 3/4 mm.

By its well-developed malar space *Trigona moorei* is readily differentiated from other very small species referred to in this paper, its distinctiveness being further indicated by the characters of separation noted in the key.

The description of *moorei* is based on two workers obtained by the Oxford University Sarawak (Borneo) Expedition, with the following data:

Sarawak: Mt. Dulit, R. Lejok, "near sweat and water," Oct. 5, 1932.

XXVI.—Trigona itama Cockerell and XXVII.—Trigona breviceps Cockerell

(Pl. III, fig. L; Pl. VI, fig. U)

Trigona itama Cockerell, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387.

Trigona itama Cockerell, 1919, Philippine Journal of Science, XIV, pp. 78, 79.

Trigona itama variety *a* Cockerell, 1919, Annals and Mag. Nat. Hist., (9), III, p. 241.

Trigona itama Cockerell, 1919, Annals and Mag. Nat. Hist., (9), III, p. 244.

Trigona itama Cockerell, 1927, Annals and Mag. Nat. Hist., (9), XX, p. 541.
Trigona bakeri Cockerell, 1919, Philippine Journal of Science, XIV, pp. 67, 71.

Trigona itama was described by Cockerell from Singapore and subsequently Cockerell identified as a variety of *itama* a specimen from Sandakan, Borneo, (Baker, 23120). The present specimens agree with the specimen so identified except that the microscopic, silvery white, appressed hairs over the clypeus, sides of face, and front are more abundant on the present specimens than on Cockerell's Bornean specimen.

Trigona itama has a well-developed malar space, in length about two-thirds of the width of the mandible at the base. The face in front is silvered over with minute pale hairs, contrasting with the long erect black bristles on the vertex. The erect bristles of mesonotum, scutellum, and mesopleura are likewise black but the feathery tomentum on the mesopleura and to each side of the shiny median area on the propodeum is silvery white. The hair of the legs, except for the golden-hued brushes on the inner side of the fore basitarsi, is exclusively or nearly exclusively black, and that is the color, too, of the hairs on the abdomen both ventrally and dorsally, those on the tergites being confined largely to the apical segments.

Trigona itama shares with *Trigona erythrogastra* the rather unusual distinction of having only a single tooth near the inner end of the apex of its otherwise edentate mandible (Pl. III, fig. L). In certain other structural respects, too, *itama* is closely related to *erythrogastra*, but the latter is a somewhat larger insect and is readily separated from *itama* by its mainly or wholly ferruginous abdomen and the light orange tint (rather more so basally than apically, where it becomes somewhat milky) of its wings and by their bright ferruginous venation and stigma; the abodmen of *itama*, in contrast, is black and its wings "dilute fuliginous."

Trigona bakeri, which Cockerell separated from *itama*, on the basis of its bare scutellum and smoother and more polished mesothorax, is in my estimation hardly to be distinguished structurally from *itama*. The greater shininess of the mesonotum of *bakeri* seems to be due not to a more polished condition of the chitin but to the absence of the fine, appressed down that covers this area in *itama*. *Trigona bakeri* is a little less hirsute not only on its mesothorax but also over the head in front. These distinctions are bridged, however, by yet a third specimen—an example from the type locality of *bakeri*, Island of Penang, that bears the identical field data. This specimen, which was withheld by

Baker when the specimen on which Cockerell erected *bakeri* was submitted to Cockerell and which was acquired subsequently by the U. S. National Museum, shares with *itama* the downy appressed hairs on the mesonotum and hence the more subdued sheen; its scutellum is hairy like that of *itama*, not largely bare like that of the type of *bakeri*. It would seem doubtful, therefore, whether *bakeri* represents more than an individual variation from *itama*.

The type of *itama*, like the type of *bakeri*, is in the U. S. National Museum; the type of *breviceps* is in the British Museum. I have not had a chance, therefore, to compare the former with the last mentioned. The homotypes I had made of *itama*, however, seem hardly separable from *breviceps*, both the length and width of head and the malar space measured on a micrometer scale being substantially in accord with the corresponding parts of *breviceps*. I have tried to indicate in the key the hair's breadth difference that may exist, using in this connection specimens of *itama* from Singapore, the type locality of *itama*, that are in the British Museum collection, but it is difficult to evaluate the difference with accuracy.

A single male collected by the Oxford University Expedition is with some hesitation assigned to *itama*. It is about the same size as the worker, black, with dilute fuliginous wings, and erect black hairs on: vertex, mesonotum, mesopleura, legs for the most part (metatarsal brush on fore legs golden), and tergites of abdomen, the hairs being rather appressed and confined largely to the apex on tergites 2–3, longer, erect, and more conspicuous on the apical tergites, resembling in all of these respects the condition of the worker. The tomentum—as distinguished from the erect hairs—on the head in front, on the mesonotum, and flanking the bare space on the propodeum, though pale, is a little duller than in the worker. The hairs of the male, however, are not so coarse as those of the worker, particularly those of the vertex and mesontum, being less thickly bristlelike.

Structurally the male differs from the worker in having the facial quadrangle narrower, the eyes rather more convergent below, the clypeus not so arched, very nearly flat, the apico-lateral extremities of the clypeus separated only briefly (by not more than half the diameter of the flagellum) from the rim of the eye, whereas in the worker the antero-lateral extremity of the clypeus is separated from the eye by a space nearly equivalent to that of the width of the mandible at its base. Especially is the malar space much reduced in the male, only a narrow linear separation intervening between the rim of the eye and the base of

the mandibles. The mandibles are elongate and well overlapping, black on their basal half, ferruginous on their apical half, twice as broad at the base as at the apex, which is diagonally truncate with a slight notch just before its inner extremity.

The hind tibiae are of a breadth and shape comparable with those of the worker, but the bare oval area at the base of the inner surface of the hind metatarsi of the worker is poorly developed to absent in the male. (While in *Trigona* subgenus *Trigona*, in which I include the species with quinquedentate or quadridentate mandibles and with branched hairs fringing the hind tibiae posteriorly, all of the males—so far known—have, like the workers, this differentiated bristleless area on the hind metatarsi, the condition is not shared by the male of the few species of New World *Tetragona* in which the worker is thus characterized. For instance, the widely distributed *Trigona* (*Tetragona*) *jaty* shows, like the present species, a divergence between the male and the worker in this respect.

Specimens of *itama* collected by the Oxford University Sarawak (Borneo) Expedition:

Sarawak: foot of Mt. Dulit, junction of rivers Tinjar and Lejok, "cultivated land now waste," Aug. 22, 1932, one worker and in "old secondary forest," Sept. 14, 1932, one male; R. Kapah, tributary of R. Tinjar, Oct. 8, 1932, "undergrowth," Oct. 8, 1932, one worker.

LIST OF *TRIGONA* REPORTED FROM BORNEO, IN CHRONOLOGICAL ORDER, WITH BIBLIOGRAPHIC REFERENCE TO THEIR FIRST MENTION AND LOCATION OF THE TYPE MATERIAL

Trigona ventralis SMITH, 1857, Journ. of Proc. Linn. Soc. Zool., II, p. 50.

Type material composite:

Sarawak specimen, believed to be part of the type material but not bearing a type label, is in the British Museum.

Mount Ophir specimen, which is not *ventralis* but *latebalteata*, is in the Wilson Saunders collection at Oxford University Museum.

Trigona apicalis SMITH, 1857, Journ. of Proc. Linn. Soc. Zool., II, p. 51.

A specimen is in the Wilson Saunders collection at Oxford University Museum.[1]

Trigona canifrons SMITH, 1857, Journ. of Proc. Linn. Soc. Zool., p. 51.

A specimen is in the Wilson Saunders collection at Oxford University Museum.

Trigona melina GRIBODO, 1893, Bull. Soc. Entom. Ital., XXV, pp. 262–263.

Trigona melanocephala GRIBODO, 1893, Bull. Soc. Entom. Ital , XXV, p. 264.

Trigona erythrogastra CAMERON, 1902, Journal Straits Asiatic Soc., XXXVII, p. 129.

The type and a cotype (from Matang) are in the British Museum.

Trigona flavistigma CAMERON, 1902, Journal Straits Asiatic Soc., XXXVII, p. 130.

(A variety of *fimbriata.*)

The type is in the British Museum.

Trigona latebalteata CAMERON, 1902, Journal Straits Asiatic Soc., XXXVII, pp. 130-131.

(A variety of *terminata.*)

Two type specimens in the British Museum.

Trigona lacteifasciata CAMERON, 1902, Journal Straits Asiatic Soc., XXXVII, p. 131.

(A variety of *thoracica.*)

The type is in the British Museum.

Trigona collina SMITH, reported by Cameron, 1908, Entomologist, XLI, p. 192.

A specimen is in the Wilson Saunders collection at Oxford University Museum.

Trigona erythrostoma CAMERON, 1908, Entomologist, XLI, p. 193.

"Type" material, in British Museum, is composite—part of it identical with *fuscobalteata*, part of it very close to *viridipennis*. But neither representative seems to be the authentic type.

Trigona fulvopilosella CAMERON, 1908, Entomologist, XLI, pp. 192, 194.

Two type specimens in the British Museum.

Trigona fusco-balteata CAMERON, 1908, Entomologist, XLI, pp. 193, 194.

Two type specimens in the British Museum.

Trigona testaceinerva CAMERON, 1908, Entomologist, XLI, pp. 193, 195.

(Probably synonym of *melanocephala.*)

The type is in the British Museum.

[1] The specimens in the Wilson Saunders collection, while not labeled as types, are believed to be of the material on which Smith's descriptions were based.

TRANSACTIONS

OF THE

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

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PRESIDENTIAL ADDRESS.

"Charles Darwin and Entomology."

BY

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Read June 30th, 1936.

I commence by thanking you for the honour you did me by asking me to preside over this meeting, and in welcoming you here I trust that you will have a very enjoyable congress in this beautiful city.

You would not have chosen to come to Oxford without considering what Oxford had to give you that could not be so well offered by other towns in the south-east of England, and from your choice of president it appears that you desire to hear something of the work for which the entomological department of the Oxford museum has earned world renown under the leadership of my distinguished predecessor Sir Edward B. Poulton, F.R.S., for 40 years Hope Professor, and successor of the first Professor, the great systematist John Obadiah Westwood.

Oxford is now recognized as the centre for the study of the coloration of insects and the bearing of entomology on evolution, and the researches conducted and inspired by Poulton have made it abundantly clear that the manifold aspects of the coloration of insects cannot be understood in all their relations on any theory so well as the Darwin-Wallace theory of Natural Selection.

Trigona pallidistigma CAMERON, 1908, Entomologist, XLI, pp. 193, 195.
The type is in the British Museum.

Trigona versicolor FRIESE, 1908, 'Nova Guinea' (l'Expéd. sci. néerlandaise sous A. Wichmann, V. Zoologie, p. 358, Pl. XV, fig. 1.
(Variety of *fimbriata*.)
Paratype in the American Museum of Natural History.

Trigona geissleri FRIESE, reported by Cockerell, 1918, Annals and Mag. Nat. Hist., (9), II, pp. 385–386.

Trigona melanotricha COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, pp. 386, 387.
(Variety of *fimbriata*.)
The type is in the British Museum.

Trigona rufibasalis COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387
The type is in the British Museum.

Trigona ambusta COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387.
(Variety of *thoracica*.)
The type is in the British Museum.

Trigona busara COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387.
(Synonym of *canifrons*.)

Trigona itama variety *a* COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 241.

Trigona geissleri FRIESE, variety *a* COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 242.

Trigona sandacana COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, pp. 242–243.
(Synonym of *luteiventris* FRIESE, which itself is a variety of *erythrogastra* Cameron.)
The type is in the British Museum.

Trigona haematoptera COCKERELL, 1919, Annals and Mag. Nat Hist, (9), III, p. 243
The type is in the British Museum.

Trigona breviceps COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, p. 244.
(Exceedingly close to, if not identical with, *itama* Cockerell.)
The type is in the British Museum.

Trigona trochanterica COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 115.
(Very closely related to *nitidiventris* Smith, possibly only a variety of it.)
The type is in the British Museum.

Trigona fuscibasis COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, pp. 115–116.
(A variety of *collina* Smith.)
The type is in the British Museum.

Trigona rufibasalis COCKERELL, var. *a* COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

Trigona scintillans COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.
The type is in the British Museum.

Trigona sericea FRIESE, 1933, Naturh. Maandblad, XXII, pp. 45–46.
(Synonym of *apicalis* Smith.)
Two paratypes in The American Museum of Natural History.

Trigona borneënsis FRIESE, 1933, Naturh. Maandblad, XXII, p. 46.
(Variety of *thoracica* Smith.)
Four paratypes in American Museum of Natural History.

Trigona iridipennis Smith, reported by FRIESE, 1933, Naturh. Maandblad, XXII, p. 46.
The type is in the British Museum.

Species and varieties of *Trigona*, not hitherto reported from Borneo, that have been added in the present paper:—

Trigona hobbyi, new species, p. 298.
The type is in the British Museum.

Trigona apicalis variety *binghami*, new variety, p. 303.
The type is in the British Museum. Allotype in the U. S. National Museum. Paratypes in the British Museum, the U. S. National Museum, and The American Museum of Natural History.

Trigona fimbriata Smith, p. 304.
A specimen of *fimbriata* is in the Wilson Saunders collection at Oxford University Museum.

Trigona atomella Cockerell, p. 311.
The type is in the U. S. National Museum.

Trigona sarawakensis, new species, p. 313.
The type is in the British Museum. Paratypes in the British Museum and in The American Museum of Natural History.

Trigona haematoptera variety *dulitae*, new variety, p. 320.
The type is in the British Museum. Paratypes in the British Museum and in The American Museum of Natural History.

Trigona moorei, new species, p. 321.
The type is in the British Museum. A paratype is in The American Museum of Natural History.

PLATES II TO VII

PLATE II

A—*fimbriata* Smith, ♀. B—*haematoptera* variety *dulitae*, new variety, ♀ (paratype). C—*canifrons* Smith, ♀. D—*apicalis* variety *binghami*, new variety, ♀ (paratype). D[1]—*apicalis* variety *binghami*, new variety, ♂ (allotype). E—*sarawakensis*, new species, ♀ (paratype). F—*collina* Smith, ♀.

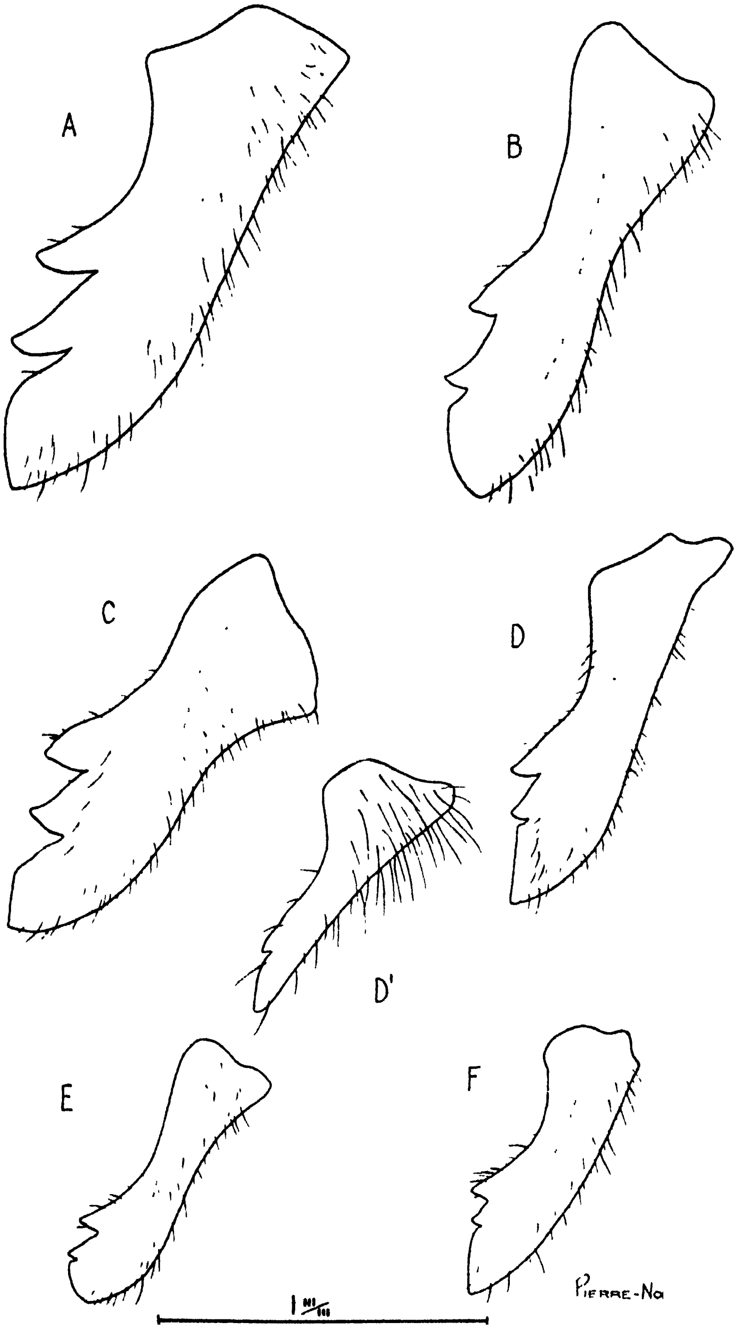

A
B
C
D
D'
E
F
1 mm
Pierre-Na

PLATE III

G—*moorei*, new species, ♀ (paratype). H—*iridipennis* Smith, ♀. I—*ventralis* Smith, ♀. J—*thoracica* variety *borneënsis* (Friese), ♀ (paratype). K—*erythrogastra* variety *luteiventris* (Friese), ♀ (metatype). L—*itama* Cockerell, ♀.

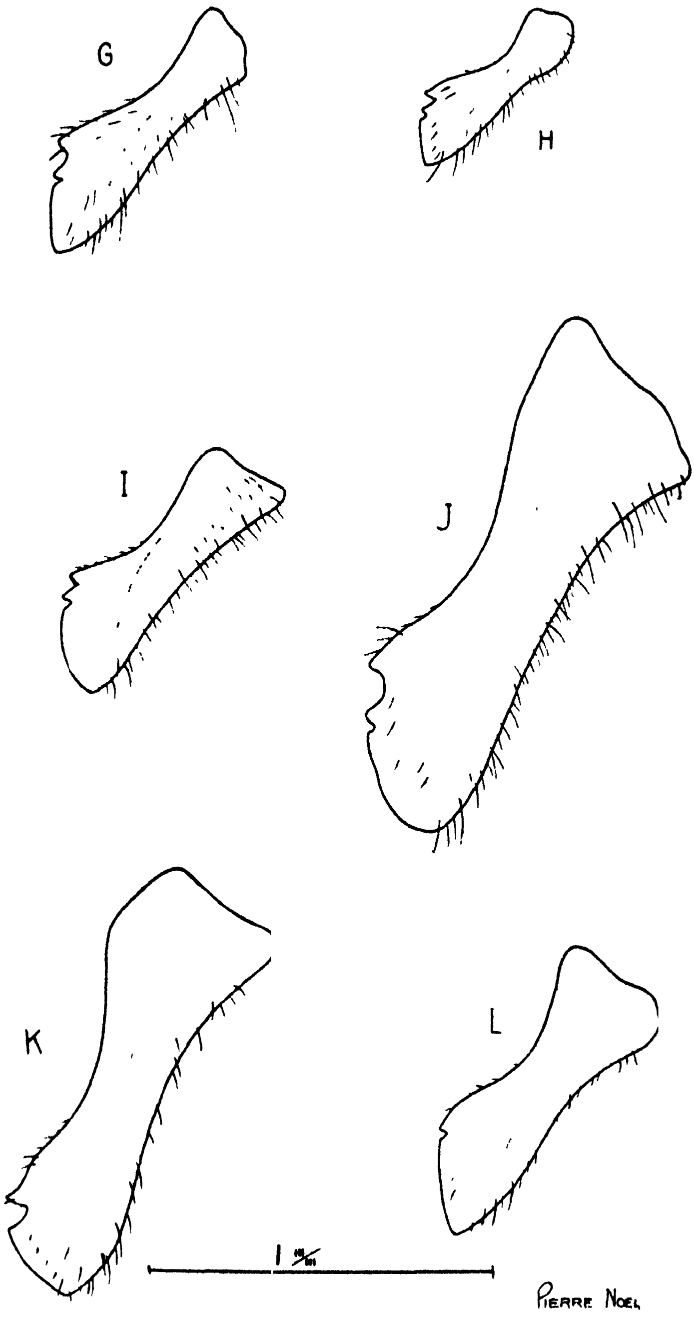

G
H
I
J
K
L
1 mm
PIERRE NOEL

PLATE IV

M and M[1] —*sarawakensis*, new species, ♀ (paratype). N—*moorei*, new species, ♀. O—*iridipennis* Smith, ♀. P and P[1]—*fimbriata* variety *versicolor* (Friese), ♀ (paratype).

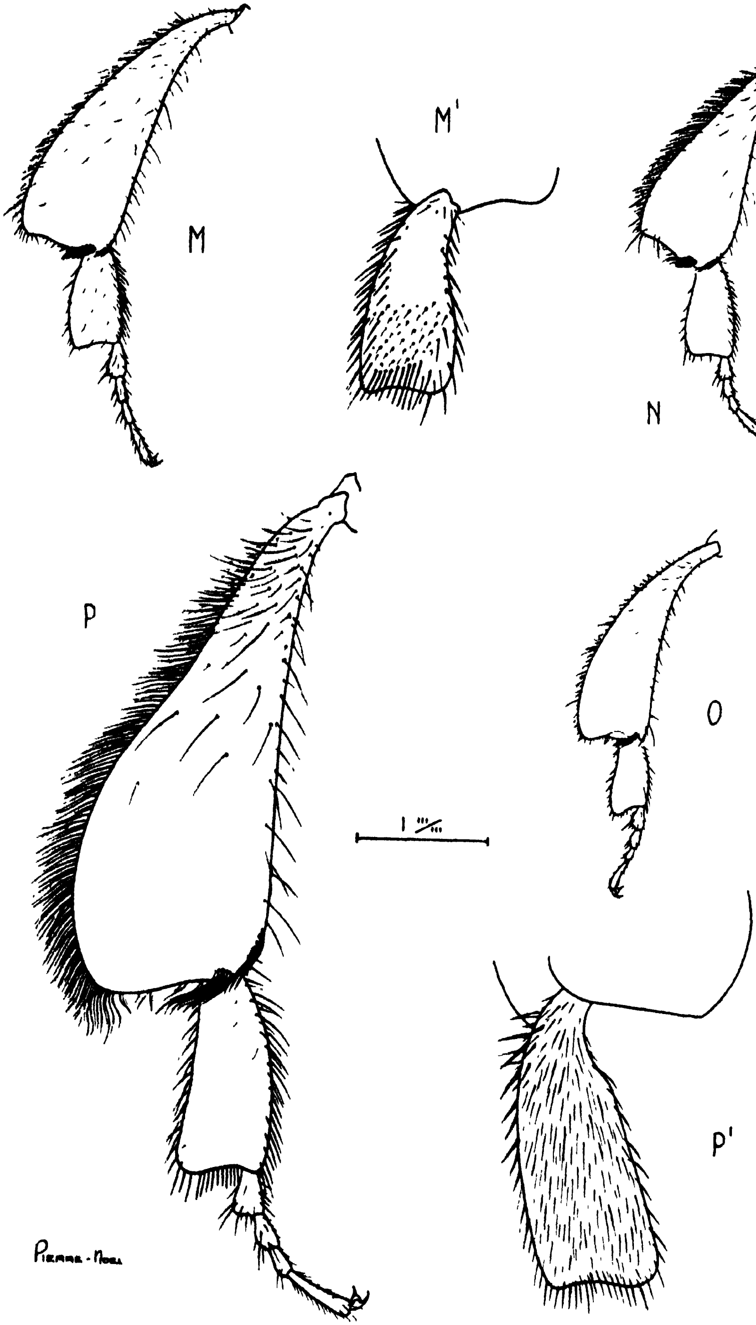

M
M'
N
P
O
P'

PLATE V

Q—*canifrons* Smith, ♀. R—*apicalis* variety *binghami*, new variety, ♀ (paratype). R[1]—*apicalis* variety *binghami*, new variety, ♂ (allotype). S *collina* Smith, ♀.

It will possibly be news to some of you that the historic debate between Bishop Wilberforce and Huxley, on the Darwin-Wallace hypothesis of evolution took place in the University Museum, on the upper storey, close to what is now part of the department of entomology, and I hope you will inspect the commemorative tablet on the wall.

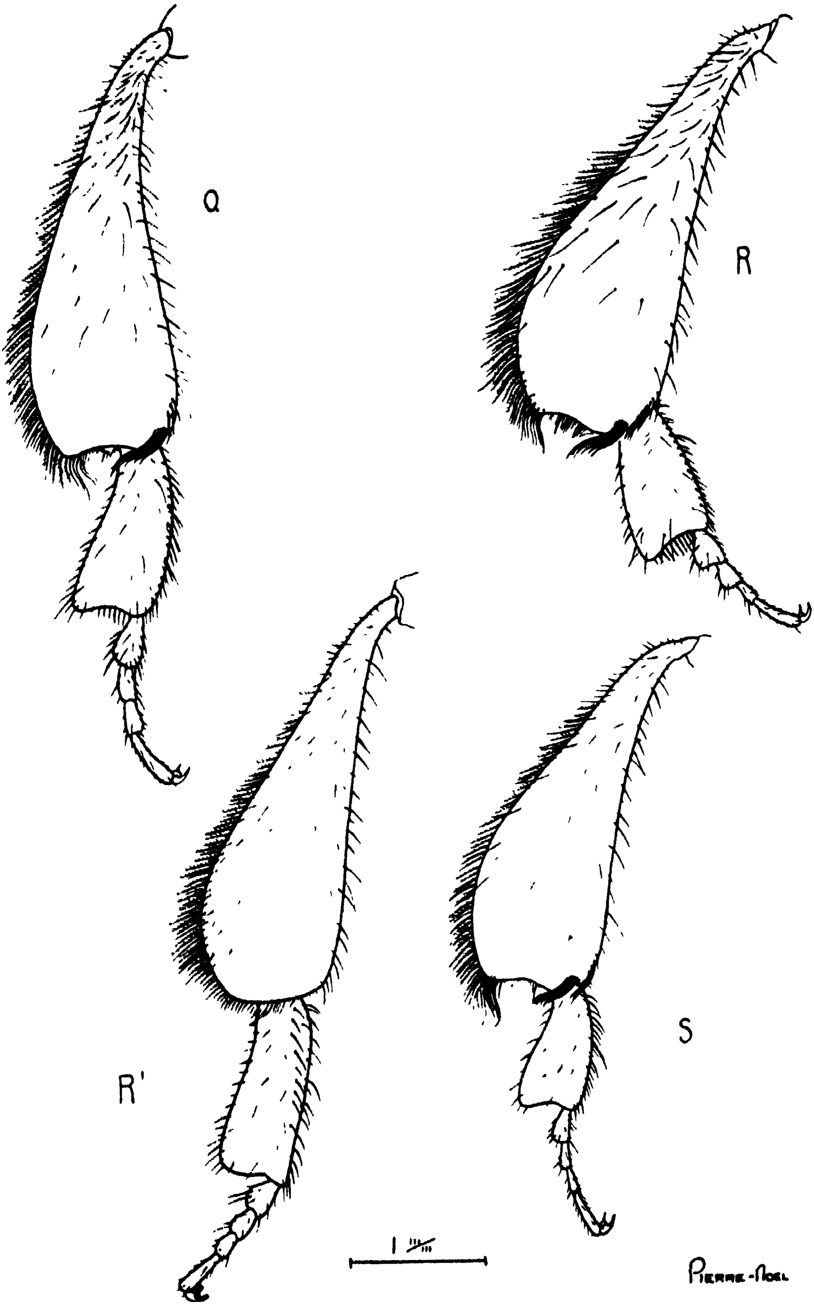
It will amuse you also, I think, to know that the first Hope Professor, Westwood, a staunch conservative of the old school, solemnly warned the young man, who was destined to succeed him in the chair, against the dangers of the new doctrine of Darwinism, and that that young man made it his life's work so that he has long been recognized as the chief authority on the application of the Darwinian principle of natural selection to the study of the coloration of insects. In following Sir Edward and studying these phenomena I have found some of my happiest moments so that you will understand why I have selected "Charles Darwin and Entomology" as the title of this address.

It is especially fitting because, only last year, we celebrated the centenary of the landing of Darwin on the Galapagos Is.—a locality which did perhaps more than any other place in the world to set his mind working and doubting the truth of the doctrine of "Fixity of Species," and of "Creation" as currently interpreted. Thus you will remember that in his "Naturalist's Voyage" (1845*) he asks why were the aboriginal inhabitants created on American types of organization? The importance of the answer to this question cannot be over-emphasized, and the facts of Geographical Distribution, which play so large a part in the evolutionary study of entomology, produce more and more evidence of evolution.

You will remember, also, Darwin's surprise at "the amount of creative force . . . . displayed on these small, barren, and

* It is interesting to note that it was not until the *second* edition that these words appear. At the time of the *first* edition, published in 1839 as volume 3 of the "Narrative of the surveying voyages of His Majesty's ships ADVENTURE and BEAGLE," etc., Darwin's ideas had not progressed sufficiently for such a question to have been asked.

We find, on p. 469, in an account of the terrestrial *Amblyrhynchus*, "It would appear as if this species had been created in the centre of the Archipelago, and thence had been dispersed only to a certain distance." He notes, on p. 474, that the general form of the organic beings in the archipelago "strongly partakes of an American character," but goes no further except to point out that the "circumstance would be explained, according to the views of some authors, by saying that the creative power had acted according to the same law over a wide area." The *second* edition, entitled "Journal of Researches" etc., appeared in 1845: the expression of surprise at "the amount of creative force" also did not occur until this time. It will be remembered that the first "abstract" of the theory was written in 1842, and enlarged in 1844.


Q
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Pierre-Noel

PLATE VI

T *haematoptera* variety *dulitae*, new variety, ♀ (paratype). U *itama* Cockerell, ♀. V *erythrogastra* variety *luteiventris* (Friese), ♀ (metatype).

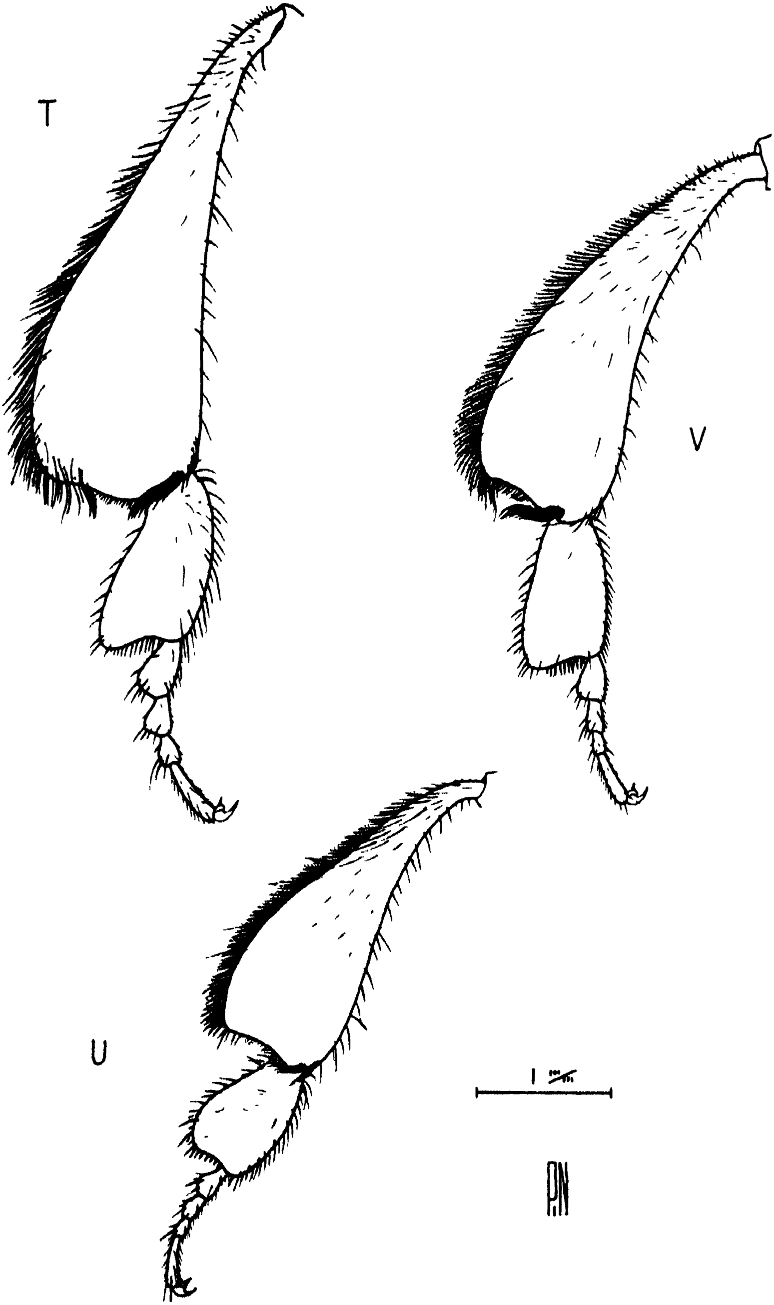
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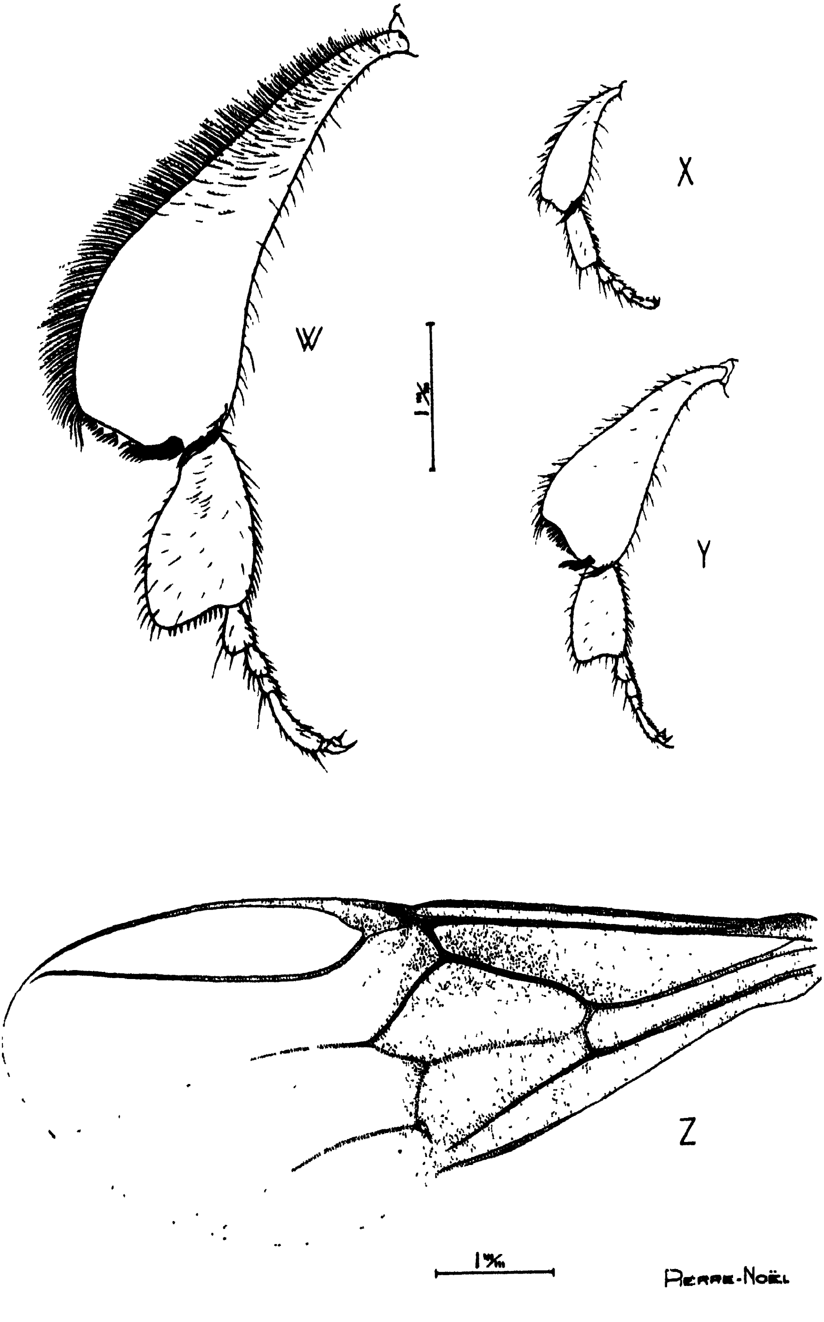
PLATE VII

W— *thoracica* variety *borneensis* (Friese), ♀ (paratype). X—*scintillans* Cockerell, ♀ (metatype). Y—*ventralis* Smith, ♀. Z—*apicalis* variety *binghami*, new variety, ♀ (paratype).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Pierre-Noël

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 11, vol. ii. p. 401, November 1938.

Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Diptera, Trypaneidæ. By F. A. PERKINS, B.Sc.Agr., Lecturer in Entomology, University of Queensland.

[Plate XV.]

THIS collection was made by Messrs. B. M. Hobby and A. W. Moore, and consists of 51 specimens belonging to seven genera. The excellent condition of the specimens makes it possible to solve one or two problems of synonymy, and the opportunity is taken of re-describing a species which has caused considerable confusion in the past. One species and a variety are described as new. Three subfamilies are represented in the collection, but it is rather surprising that no species of Dacinæ were collected.

Subfamily *ADRAMINÆ.*

Of this subfamily there is only one species, the well-known *Adrama determinata* Walk., an important pest of tea seeds. It is represented by two males and one female, from the foot of Mt. Dulit, junction of the rivers Tinjar and Lejok, 28. viii. 1932 (cultivated land, now waste); and 1 male and 1 female, Mt. Dulit (4000 ft.), Oct. 1932 (primary moss forest).

Subfamily TRYPETINÆ.

This subfamily is represented by five large handsome species, belonging to the following genera :

Genus RIOXA Walk., 1857 *a*, p. 35.

Of this genus, there is one species, *R. lanceolata* Walk., the genotype, originally recorded from Singapore, and also from Borneo, Sumatra, and Java. Three males from Mt. Dulit, Dulit trail, 9. ix. 32 (undergrowth, old secondary forest) ; Mt. Kalulong (1500 ft.), 7. xi. 32 (primary forest) ; foot of Mt. Dulit, junction of rivers Tinjar and Lejok, 5. x. 32 (undergrowth, old secondary forest).

Genus SOPHIRA Walk., 1857 *a*, p. 34.

Only one species, *S. limbata* End., previously recorded from Sumatra. This fine species is represented by 11 females from Mt. Dulit, junction of rivers Tinjar and Lejok, Aug. 1932 (on bark of felled trees) ; and Mt. Dulit 4500 ft.), 14. x. 32 (moss forest).

Genus COLOBOSTROTER End., 1911, p. 445.

This peculiar genus was erected in 1911 by Enderlein for *pulchralis*, the only known species of the genus. It is doubtful whether it should be placed in the subfamily Trypetinæ. In the absence of *pvt.*, *hm.*, *prst.*, and *dc.* bristles, it is more like a species of the subfamily Dacinæ. On the other hand, the plumose arista, the wing-venation, and the wing-pattern indicate its relationship to species of Trypetinæ. It differs from species of both subfamilies in having no *s.or.* outer *vt.*, *pt.*, and *st.* bristles, the presence of a short R_3, and in the thick covering of very long hairs on the thorax and abdomen. The fact that *sc.* is not bent sharply at right angles suggests that it might not belong to the family Trypaneidæ.

The genus is represented by the genotype, *C. pulchralis* End., which was originally described from Sumatra. Enderlein in his description of this species stated that it has six scutellar bristles. In this specimen there are only four strong bristles. On each side there are about fourteen very weak bristles, but they cannot be compared with the *sc.* bristles. Perhaps he considered that one of these weak bristles was the middle *sc.* bristle. It seems

better to say that there are only four *sc.* bristles, ignoring the numerous weak bristles.

Genus Acanthoneura Macq., 1843, p. 220.

Syn. *Themara* Walk., 1857 *a*, p. 33.

This genus was erected by Macquart for *A. fuscipennis* from Bengal. Since then the type has not been redescribed, and Mons. Séguy of the Museum of Natural History, Paris, informed me that it is definitely lost. Bezzi (1913, p. 117) very briefly described a male and female from Assam, which he considered were identical with this species. He recorded them as such. Recently three specimens from Bengal were sent to me by Mr. Senior-White, and they appear to be the same as *A. fuscipennis* Bezz., and also agree with the original description of *A. fuscipennis* Macq., in all the characters mentioned in that description. The wing-pattern differs from Macquart's figure in certain details. In his figure, only R_1 and R_{4+5} are shown to be bristly; whereas in Bezzi's description, and in the above-mentioned specimens from Bengal M_{1+2}, M_{3+4}, and the posterior or *m* cross-vein are also bristly. The bristles on R_1 and R_{4+5} are longer and much more obvious than those on the other veins, and could easily have been overlooked. Moreover, it must be remembered that 100 years ago the chætotaxy of the head and thorax and the bristles on the wing-veins were not considered to have much generic value.

Walker (1857) erected the genus *Themara* for *ampla*, a species which agrees in every generic character with *A. fuscipennis* Bezzi, and with the three specimens mentioned above from Bengal. They all have the broad frons, thoracic chætotaxy complete, orbital bristles 2 : 2, R_{2+3} very wavy, R_1, R_{4+5}, M_{1+2}, M_{3+4}, and *m c-v* bristly. *A. fuscipennis* Bezz. and *T. ampla* Walk. are certainly congeneric.

Hendel (1928, p. 355) separated *Themara* from *Acanthoneura* on the presence of bristles on M_{3+4}. Evidently he did not consider *A. fuscipennis* Bezz. to be the same as *A. fuscipennis* Macq. It is possible that he was right, but there is no evidence to support such a view. Until far more collecting has been done in Bengal, it is not possible to decide whether Bezzi was right or not. The

three specimens from Bengal, the type-locality of *fuscipennis* Macq., are certainly congeneric with *ampla* Walk., and they are the only recorded specimens from Bengal which resemble Macquart's figure, and agree with his description. To overcome the difficulty and confusion existing at the present time, three solutions are possible :—

(1) To follow Bezzi and sink *Themara*, confining the genus *Acanthoneura* to those species with R_1, R_{4+5}, M_{1+2}, M_{3+4} bristly, in addition to other characters. If this is done, it will be necessary to make a new genus for those species which have M_{1+2} and M_{3+4} bare. In view of the doubt, lack of accurate knowledge, and paucity of material from Bengal, it does not seem desirable to erect another genus and very possibly add to the confusion.

(2) To ignore the genus *Acanthoneura* because the original description is inadequate and the type no longer in existence, and to regard *Themara* Hend. (type *ampla*) a valid genus. It would then be necessary to erect a new genus for those species with M_{1+2} and M_{3+4} bare. For such a procedure, it would necessary to have the support and approval of the International Commission for Zoological Nomenclature ; and the above-mentioned objections to the erection of a new genus still apply.

(3) To keep the limits of the genus *Acanthoneura* rather wide, and not to limit it as suggested by Hendel. *Themara* becomes a synonym, and there is no necessity to erect a new genus. This appears to be the most satisfactory solution. Most of the species show a remarkable resemblance to one another, and the total number of described species is not large enough to cause difficulties in identification. It is the solution adopted in this paper, and it is suggested that it be adopted by other workers until more accurate information is available.

The genus *Acanthoneura* is defined as follows : Occiput not swollen ; frons variable ; arista plumose with three rows of cilia, two dorsal and one ventral ; orbitals usually 2 : 2 ; *pvt.* strong ; ocellar bristle weak ; thoracic chætotaxy complete ; no propleural bristle ; 2–3 *mpl.* ; supra-alar bristles three ; 3 pairs of scutellar bristles, of which the middle pair is usually weaker ; 1 spur on middle tibiæ ; front femora bristly ; R_{2+3} wavy ; *r-m cv.* distinctly after the middle of the median cell ; at least C, R_1. and R_{4+5} bristly above.

rocky islands." We will allude to the entomology of these islands in a moment.

Darwin was in his youth so enthusiastic a collector of beetles that it seems at first sight strange that insects played so small a part in his writings in later years, except when he was dealing with his doctrine of Sexual Selection in the "Descent of Man," and special subjects such as fertilization of flowers. He wrote in his autobiographical chapter, "But no pursuit at Cambridge was followed with nearly so much eagerness or gave me so much pleasure as collecting beetles . . . . it was the mere passion for collecting." He does not seem to have been especially attracted by habits or life-histories, and might equally well have collected anything else. Great as were his discoveries in other lines of biology he did little for entomology as it then was: what he has done for entomology, indirectly, I hope to make plain.

But one insect which he noted in Australia may justly be claimed to have done a great deal towards forming Darwin's views, expressed in 1844 (1), that "species are not immutable." The insect which can claim this great honour is one of the "Ant-lions." This name (or its reverse "Lion-ant" as used by Darwin) refers to the larvae of a certain group of insects which dig conical pits in loose sand and lie in wait at the bottom for insects which slip down the loose sandy slope and are prevented from climbing up again by showers of sand hurled at them by violent movements of the larva at the bottom of the pit. Darwin writes in the M.S. diary of the voyage (2, p. 383) that he observed a "Lion-ant" in New South Wales behaving exactly as Kirby had recorded for European species. "Would any two workmen have hit on so beautiful, so simple, and yet so artificial a contrivance? It cannot be thought so. The one hand surely worked throughout the universe."

Thus, the reflection that he had just previously recorded, upon the strange character of Australian animals compared with those of the rest of the world, which might have led anyone to suppose that two distinct creators must have been at work with the same object, was set at nought by the habits of an insect: there must have been Unity of Creation—thus a step was made in the definite formulation of the new idea.

The subsequent history of this observation, as pointed out by Mrs. Barlow (*loc. cit.* p. 439), is most interesting. In his *first* edition of the "Origin" the original observation and reflections

So defined, *Acanthoneura* is easily distinguished from other genera of the Trypetinæ. It is represented by the following species :—

1. *Acanthoneura hirtipes* Rond.

This species is very close to *A. maculipennis* Westw. In the males the eye-stalks are usually longer and more slender, the facial dark band is always confined to the oral margin, and in width is always about one quarter of the median length of the face. The fore coxæ and prosternum vary from fulvous to light brown, but are never dark fuscous or black as in *maculipennis*. In the wings R_{2+3} curves more gradually towards the costa, and ends closer to the end of R_{4+5} than the end of R_1. The costa is not abnormally thickened between R_1 and R_{4+5} as in *maculipennis* and *ampla*. Unfortunately, the females are practically identical, the legs are uniformly fulvous to light brown in both species, the wing-markings and waviness of the veins are identical. The only difference between the females of the two species is the width of the facial band. In *hirtipes* it is confined to the outer, or lower, slope of the carinal furrow, whereas in *maculipennis* it extends almost to the base of the antennæ. In teneral and light-coloured specimens the facial band is only a little darker than the rest of the face, but is usually quite distinct if viewed from the side. *A. hirtipes* is only known from Borneo and Sumatra, and *A. maculipennis* from Java and Malaya.

It is possible that *hirtipes* is the same as *fuscipennis* Macq., but Bezzi (1913, p. 117) states that the head of the male of *A. fuscipennis* is very different from *Achias horsefieldi* Westw., which is a synonym of *A. maculipennis* and consequently has stalked eyes. It is inferred that in the male of *A. fuscipennis* Macq., according to Bezzi, the eyes are not stalked.

Enderlein (1911) confused *hirtipes* and *maculipennis*. His species *montina* (described from a single male), in which the legs are dark brown, R_{2+3} ending about half-way between the end of R_1 and R_{4+5} ; with a very broad head ; with a broad dark brown facial band ; and the thorax with three narrow longitudinal stripes, is evidently *A. maculipennis* Westw., and his *maculipennis* is *hirtipes* Rond.

Thanks to Dr. J. Smart of the British Museum, it is possible to fix *A. maculipennis*. A series of specimens from Malaya, Java, and Borneo were sent to him for comparison with the types of *maculipennis* Westw., *horsefieldi* Westw., and *ampla* Walk. He indicated which of the specimens were identical with the above types, and the synonymy recorded above is based on the material examined and checked by Dr. Smart. A more complete account of the synonymy of the above species will be recorded in another paper.

Rondani's original description was very brief and incomplete; consequently, having available a long series of specimens in excellent condition, the opportunity is taken to re-describe this rather confusing species.

Male.—Length of body 8 mm., of wing 9 mm.

Frons fulvous, shaded with dark brown or black; very broad, extended on the sides to form very striking and characteristic eye-stalks, which vary considerably in length, the proportion of length (measured from the median ocellus to lunule) to width varies from 11 : 249 to 8 : 68; ocellar triangle black; antennæ short, about two-thirds the shortest length of the face; dark fulvous; 1st and 2nd segments very short; 3rd segment about four times as long as 2nd; 2nd segment bristly; arista longer than face, plumose. Face pale fulvous with a narrow black band on the anterior extending on the genæ as far as the base of the eye-stalks; transverse carinal furrow rather broad, palps fulvous, covered with numerous short fine black bristles; genæ fulvous with a median transverse dark brown band; occiput fulvous.

Chætotaxy: *Vt*.2 (very wide apart); *pvt*. (strong); *oc*. (weak); *s.or*.2: *i.or*.1; genal bristle; occipital row weak; all black.

Thorax.—Colour varying from fulvous to dark brown, with rather indistinct narrow black longitudinal lines, two median and a short post-sutural line on each side; most of the posterior portion of the mesonotum black; the humeral calli, propleuræ, prosternum, mesopleuræ, pteropleuræ, and most of the sternopleuræ lighter than the rest of the thorax; covered with short black hairs. Scutellum dark brown to black, sometimes lighter towards the apex.

Chætotaxy: Complete. *Scp*. strong; *mpl*.2; *dc*. distinctly behind the line joining the anterior *s.a.*; *sc*.3 pairs, the middle pair very weak.

Legs.—Vary from fulvous in lightest-coloured specimens to brown ; tibiæ darker than other segments ; front femora with two rows of 8–10 bristles ; hind tibiæ with two long bristles on the outer side ; middle tibiæ with a long spur and several shorter bristles.

Wings.—Pattern as shown in the photograph. The following veins distinctly wavy—R_{2+3}, last section of R_{4+5}, and last section of M_{1+2} (slightly), R_1, R_{4+5}, M_{1+2}, M_{4+5}, posterior cross-vein, and the basal section of Cu1 bristly above. R_1 (at the end), R_{2+3} (thickly), R_{4+5}, M_{1+2}, and posterior cross-vein bristled below. Stigma shorter than 2nd costal cell, the proportion (measured along C) being 2nd C to stigma 39 : 33. R_{2+3} ending on C closer to the end of R_{4+5} than R_1, the proportion (when measured directly and not along C) being end of R_1 to R_{2+3} : R_{2+3} to R_{4+5} : : 49 : 27.

The last curve of R_{2+3} gradual and not steep as in the male of *A. maculipennis.* The *r–m* cross-vein short and straight, the sections of M_{1+2} before and after it being in the proportion of 48 : 17. The extension of cell Cu short, its length in proportion Cu1 + 1A being 11 : 17.

Abdomen black with the first tergite, the anterior and posterior border of the 2nd, and the posterior border of the 5th (in the middle) fulvous. All the tergites covered with long black hairs, and a row of long black bristles along the posterior border of each tergite.

Female.—Frons broad, but constant in width, not extended to form eye-stalks, the proportion being length to width 10 : 20 ; slightly narrowed anteriorly. R_{2+3} the same as in the male ending well after halfway between the end of R_1 and R_{4+5}. Basal segment of ovipositor short, broad, flat ; fulvous, with the apex black.

This species is represented by 23 males and 5 females from the foot of Mt. Dulit, junction of rivers Tinjar and Lejok, Aug. and Sept. 1932 (on bark of felled trees, old secondary forest).

2. *Acanthoneura hirsuta*, sp. n.

Male.—Length of body 6 mm., of wing 5 mm.

Head.—Frons varies from fulvous to pale brown, darker above the lunule, slightly longer than wide, the proportion being length (measured from median ocellus to lunule) to width 12 : 11 ; ocellar triangle black ; vertical calli distinct, shining, reaching the middle of the frons.

Face fulvous. Antennæ much shorter than face; fulvous; 1st and 2nd segments bristly; the proportion of the segments being 4 : 9 : 28, arista longer than face, plumose. Occiput and genæ fulvous. Palps bristly and fulvous in colour.

Chætotaxy.—*Vt.*2; *pvt.* strong and parallel; *oc.* weak; *s.or.*2, the upper weaker than *pvt.*; *i.or.*2, lower weak; genal bristle; occipital row strong; all black.

Thorax.—Dark fulvous to pale brown, with several dark brown or black stripes and markings; practically all the posterior part of the mesonotum black; two median black stripes; black patches in front of the suture, above the wings, on the mesopleuron, sternopleuron, pteropleuron, the lower half of the humeral calli, and post-scutellum. The propleuron, anterior part of the mesopleuron, and the prosternum light fulvous. Scutellum black with the apex fulvous.

Chætotaxy: Complete; *mpl.*2; *pt.* weak; *sc.*3 pairs, the middle pair very weak.

Legs.—Fulvous with hind tarsi dark brown. Remarkable for the several rows of numerous strong black bristles on the front femora; 2–3 long bristles on the hind tibiæ; middle tibiæ with a long spur.

Wings.—Pattern as in photograph. R_{2+3} (excessively), R_{4+5}, M_{1+2} wavy. C, R_1, R_{4+5}, M_{1+2}, M_{3+4}, and the base of Cu1 bristled above. Stigma and 2nd costal cell exactly the same length when measured along C. R_{2+3} with a shallow curve above the *r-m cv.*, and then above the posterior cross-vein it slopes steeply towards C, and then turns and runs into C gradually, much closer to the end of R_{4+5} than R_1, the proportions being end of R_1 to R_{2+3} : end of R_{2+3} to R_{4+5} : : 28 : 20. The sections of M_{1+2} before and after the *r-m cv.* in proportion of 26 : 13.

Abdomen.—Shining black with the first visible tergite, and the fore and hind margin of the 2nd fulvous; covered with long black hairs, and with a row of black bristles along the posterior margin of the tergites.

Described from two males from the foot of Mt. Dulit, junction of the rivers Tinjar and Lejok, Sept. and Oct. 1932 (on bark of felled trees). Types returned to the British Museum.

Acanthoneura hirsuta var. *nigrifacies*, nov.

There is one specimen which agrees in most characters with the above species, but differs in having the face uniformly black, the legs dark brown or black except for the under side of the front femora, and the tarsi which are fulvous. The thorax is mostly black, and there appears to be three longitudinal black lines instead of two. This is possibly a distinct species, but, until a longer series has been examined, it seems preferable to regard it as a variety. One male from the foot of Mt. Dulit, junction of Tinjar and Lejok rivers, 27. viii. 32. Type returned to British Museum.

Subfamily *Tephritinæ*.

The only specimen of this subfamily included in the collection is the widely distributed *Platensina sumbana* originally described from Sumatra by Enderlein in 1911.

One female from River Kapah, tributary of the river Tinjar, 5. x. 32.

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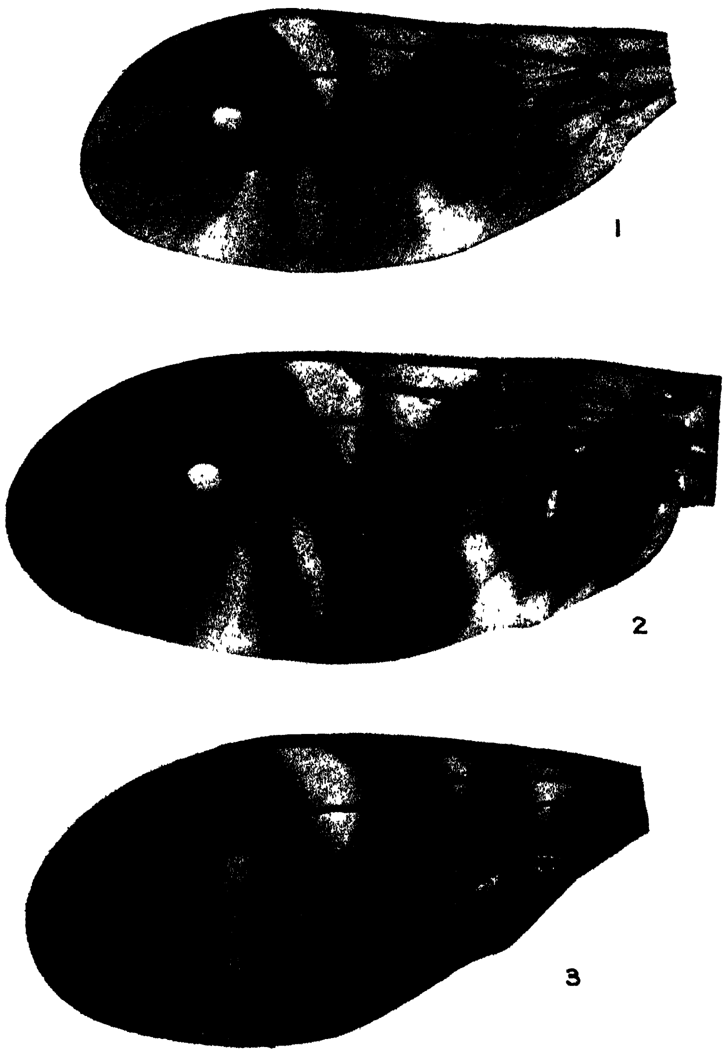
EXPLANATION OF PLATE XV.

Fig. 1. *Acanthoneura maculipennis* West. Wing of male.

Fig. 2. *Acanthoneura hirtipes* Rond. Wing of male. Anal lobe slightly folded.

Fig. 3. *Acanthoneura hirsuta*, sp. n. Wing of male. Anal lobe slightly folded.

N.B.—Some of the veins have been retouched.



WINGS OF TRYPANEIDAE (DIPT.) FROM BORNEO.

46

[*Reprinted from the Journal of the Society for British Entomology. Date of publication, 14th August, 1936.*] [*Vol. 1, Part 6*]

The use of sweep net samples in an Ecological Survey.

Standardisation of sampling techniques should be made for each area used in the investigation of the distribution of fauna and flora since the type and nature of dispersal of forms differs greatly in different habitats. The present study here presented is an analysis of preliminary investigations regarding this subject on the animal communities of several grassland habitats at Headington Wick, near Oxford. The method under scrutiny is that of the use of sweep-nets, and the optimum size of sample necessary to give an adequate representation of what is present.

Sweep-net samples (*i.e.*, the population taken in a given number of sweeps over a given area) include only such animals as may be active in the upper grass strata, and hence are indicative of the state of activity and presence of certain species; they cannot be used as a basis for the measurement of the absolute population density. The method is very useful in comparing the differences between faunas and their relative abundance from season to season, and from place to place.* Many factors influence the number of individuals taken in a particular sample: the nature of the weather and of the vegetation, as well as the personal co-efficient of error in sweeping. These factors lead to certain natural and expected deviations from the ideal and the data so obtained may at first seem rather meaningless. It is for this reason that certain workers, *e.g.* De Long ('32) and Gray and Treloar ('33), have deprecated the use of this method for practical investigations. Zubareva ('30) called attention to the part played by the human factor in the making of samples by sweeping; this work, which is essentially substantiated by the present paper, showed that certain collectors may be more consistent in their collecting results than others, and further, that some persons will consistently obtain greater numbers in their samples than others. In the Table I the individual collectors are indicated with their collections.

Thus we see that the optimum sample (*i.e.*, the sample in which is obtained the greatest number of species and individuals for the smallest number of sweeps, with the least degree of error) may vary in different habitats. Also since the composition and magnitude of an active population may change rapidly, and since weather conditions affect the activity of invertebrates, it is necessary to determine the optimum sample from a series taken simultaneously. The authors are much indebted to the following students in the Department of Zoology and Comparative and the School of Forestry, Oxford: Miss D. Dow, Miss S. B. Andrews, Mr. H. G. Vevers, Mr. A. D. W. Sandison and Mr. T. W. Summers.

The method involved essentially the use of a series of samples of different numbers of sweeps taken by several persons at the same time and in the same habitat. This operation was undertaken on two different habitats on three days (May 9, 11 and 18, 1936), each day differing somewhat as regards weather conditions.

1. The Habitats. (i) The *Holcus* community occupied the larger of the two habitats studied; it was dominated largely by the grass which gives the community its name. The average height of the vegetation is about 10 cm. Samples taken here

* For a further discussion on results which may be obtained by the sweep net method, see Carpenter, *Journ. Anim. Ecology*, November, 1936.

were repeated from the MS. journal except for a sentence suggesting there might have been two distinct periods of Creation. But by the date of the *second* edition all mention of a "Creator" was deleted, and the observation alone appeared as a footnote. Thus it may be claimed that the Ant-lion had a distinct influence on the growth of his views, mainly owing to the facts of Geographical Distribution which had so impressed him in the Galapagos Islands.

It is of such interest to compare the thoughts evoked in Darwin by the Ant-lion, with earlier views, that I cannot resist quoting from the first edition of Oliver Goldsmith's account published in 1774 (8).

A brief general description is given of "the ant-lion, in its reptile state" and the fact is mentioned that "it changes to a dragon-fly," and, "when it becomes an inhabitant of air, in every respect resembles that which has been already described." But "it is in its reptile state that it differs from all other insects." After the description of the larva Goldsmith continues—"To a form so unpromising, and so ill provided for the purposes of rapacity, this animal unites the most ravenous appetites in nature; but to mark its imbecility still stronger, as other animals have wings or feet to enable them to advance towards their prey, the ant-lion is unprovided with such assistance from either. It has legs indeed; but these only enable it to run backward, so that it could as soon die as make the smallest progressive motion. . . . But Nature, that has denied it strength or swiftness, has given it an equivalent in cunning, so that no animal fares more sumptuously, without ever stirring from its retreat." Then follows a quite excellent account of the habits, etc.

The view, to our mind so peculiar, that "Nature" endowed a certain animal with defects, and then proceeded to counterbalance these defects by other gifts, is particularly well expressed in an abridged edition of the work, published in one volume in 1807. On p. 384, after an allusion to the fact that the insect "can only move backwards," the following occurs: "This defect, in the conformation of the lion-ant, might be attended with very fatal effects, if cunning did not supply the imperfections of Nature, and, as it cannot pursue, teach it to *ensnare* its prey . . . etc."

There is no time now to dilate upon the contrast between the views of Goldsmith and of Darwin—but I would ask you just to reflect on the two sentences "if cunning did not supply the imperfections of Nature," and, "Would any two workmen have hit

TABLE I.

Individual Catches.

Holcus community.

No. of sweeps in sample.	Number of animals per sample. 1st day. A	B	C	2nd day. B	D	E	F	3rd day. A	C	F	G	Total means for all days (indiv. samples).
25	10	4	8	5	3	9	4	16	9	6	4	7.09 ± 1.07
50	10	2	6	10	24	18	16	34	22	17	8	15.18 ± 2.79
75	24	14	24	23	15	17	23	37	12	16	21	20.54 ± 2.11
100	22	15	27	14	27	33	72	35	5	14	29	26.63 ± 5.33
125	22	26	48	43	11	30	34	55	8	11	20	28.00 ± 3.78
150	13	17	31	47	47	47	83	53	37	19	15	37.18 ± 6.45
						Exposed area.						
50	19	11	38	22	17	15	18	28	72	10	10	23.63 ± 5.46
75	22	13	52	37	22	39	57	31	48	10	9	30.90 ± 5.16
100	39	18	63	43	19	42	74	59	55	11	11	39.45 ± 5.30
125	14	12	13	43	61	115	122	44	80	16	19	49.00 ± 12.36

TABLE II

Daily Means ± Standard Errors

Holcus community

No. of sweeps in sample.	Mean number of animals per sample per day. 1st day. Mean ± S.E.	2nd day Mean ± S.E.	3rd day. Mean ± S.E.	Mean of three days.
25	7.33 ± 1.82	5.25 ± 1.31	8.75 ± 2.62	7.11 ± 1.18
50	6.00 ± 2.31	17.00 ± 2.88	20.25 ± 3.89	14.41 ± 4.31
75	20.66 ± 3.33	19.50 ± 2.06	21.50 ± 5.48	20.55 ± 0.73
100	21.33 ± 3.47	36.50 ± 12.48	20.75 ± 6.71	26.19 ± 5.12
125	32.00 ± 8.08	29.50 ± 6.72	23.50 ± 8.51	28.33 ± 2.52
150	20.33 ± 4.67	56.00 ± 9.00	31.25 ± 8.96	35.86 ± 10.55
		Exposed area		
50	22.23 ± 8.02	18.00 ± 1.47	30.00 ± 14.63	23.41 ± 3.51
75	29.00 ± 11.79	37.75 ± 7.16	24.50 ± 9.33	30.75 ± 4.21
100	40.00 ± 13.00	44.50 ± 11.29	34.00 ± 13.30	39.50 ± 2.73
125	13.00 ± 0.57	82.75 ± 18.14	39.75 ± 13.33	44.87 ± 20.32

TABLE III.

Percentage Standard of Error of Daily Means.

Holcus community.

Number of sweeps in sample		Percentage standard error of daily means. 1st day.	2nd day	3rd day.		% S.E. of total means.
25	..	24.77	25.02	29.94	.	14.30
50	..	38.50	16.94	19.21	...	29.92
75	...	16.14	10.56	27.16	...	3.54
100	...	16.31	27.16	32.32	...	19.55
125	...	25.25	22.26	36.21		8.90
150	...	22.97	16.07	28.67	...	29.43
			Exposed area			
50	...	36.06	8.16	48.76	...	15.36
75	...	40.65	18.48	38.08	...	13.68
100	...	32.50	25.37	39.12	..	7.75
125	...	4.38	21.92	33.55	...	45.26

were eleven each of 25, 50, 75, 100, 125, and 150 sweeps, three being taken the first day, and four on the other days. (ii) The exposed area which was the other habitat studied was much smaller than the *Holcus* area, and was dominated by many small rosette plants of mixed species; the vegetation here was in no place more than 4 cm. high. In this habitat there were two very abundant insects, *Ancylis comptana* Fröl. (Tortricina), and a Tipulid, whose distribution will be discussed in a later paper. There were no species similarly consistent and abundantly present in the former habitat during the season under discussion.

2. Reliability of Different Sized Samples. Table I gives the total number of organisms taken by various collectors in different sized samples on the three days in both areas. In Table II these results are expressed as daily means for each size of sample together with their respective 'standard errors' ($\frac{S}{\sqrt{n}}$, S being calculated from the formula for the standard deviation). In Table III these standard errors are expressed as percentages of mean samples. In the fourth column of means for all three days, the S.E. expresses the variation between daily means, not as in the corresponding column of Table I which lists variation between individual samples.

From these tables it is evident that in the *Holcus* habitat a sample of 75 sweeps is the most reliable, the variations between samples of this size being least on the first two days, and second lowest on the third day. Moreover, the variation of daily means shows a greater consistency for this sample than for any other. In the exposed area the errors are greater but it appears that in this case the most consistent results are to be obtained with a sample of 100 sweeps.

3. The Personal Factor. It is evident from Table I that there are great differences in the results obtained by different persons. This depends to a certain extent on experience. On the first day the largest collection was obtained by the most experienced person (*C*), and similarly on the second day by *F*; but on the third day when *C* and *F* were both operating they obtained the lowest figures. It was thought also that the consistently low figures by all three persons for the largest samples in both habitats on the first day may have been due to fatigue, but this effect was not evident on either of the other days.

4. Deviation of the Mean Collection for each Day from the Total Mean for each Habitat. The apparent lack of random dispersal on the part of the population was, on first examination, rather evident. It was found on close examination, however, that the 'patchiness' of distribution differed some-

what under the weather conditions of the three days studied. The theoretical number of animals which should have been obtained per sweep was determined for each day's collection for

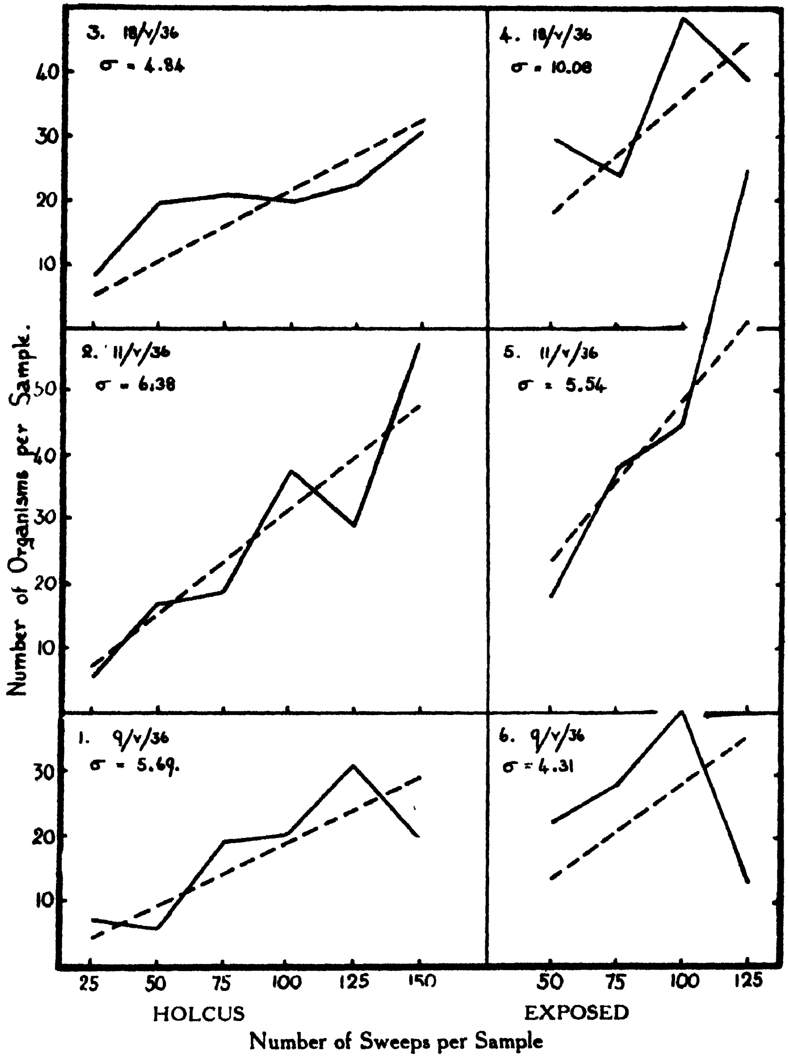


FIG. 11.—Headington Wick Grassland.

each habitat. This was done by calculating the number of animals taken in an average single sweep and multiplying by the number of sweeps taken. From this calculation was ob-

tained the number of animals which might have been expected had the distribution been at random (represented by the broken lines in Figs. 11 and 12). From the difference between the mean of all samples of a given size for a given day and the expected for that size the standard deviation (σ) was found.

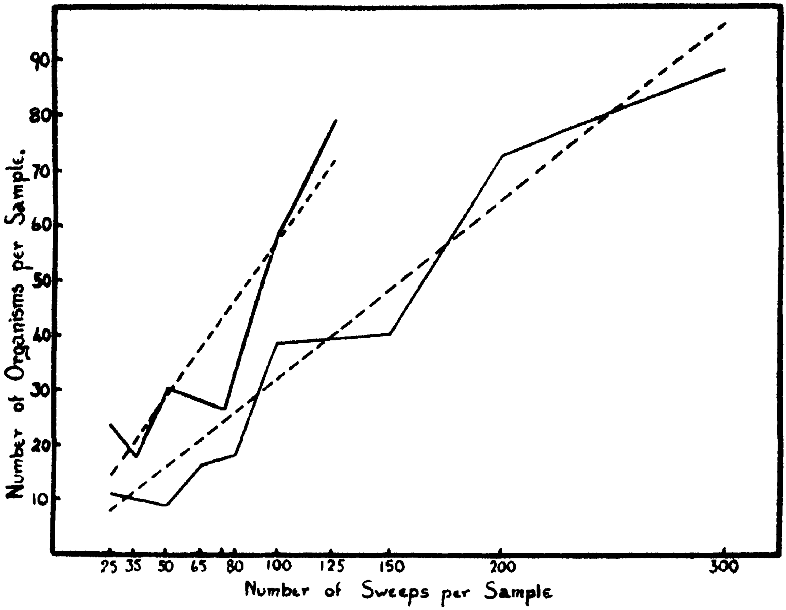


FIG. 12.—Oklahama Prairie Grassland.

This is given as an index of the degree of patchiness, or the extent to which the actual condition of dispersal differed from the theoretical random (see Table IV).* Both the theoretical and obtained figures are shown in Fig. 11 for the *Holcus* (graphs 1-3) and Exposed (graphs 4-6) stations in the three sets of collections.

TABLE IV.

Variation between daily mean samples taken and expected, in terms of σ, with accompanying data on weather.

	9/iv.	11/iv.	18/iv.
Holcus	5.69	6.38	4.84
Exposed	4.31	5.54	10.08
T° F. (4 ft.)	51°	68°	70°
Rel. Humid.	82%	40%	42%
Sky	Dull	Bright	Bright
Wind	—	—	+

* In this argument the personal factor was considered as being overcome or at least greatly reduced since the daily means were used instead of the individual catches.

This would appear to show that the degree of dispersion of populations is not constant but varies with the kind of day, and differently in different habitats.

(In a former study on two prairie habitats (Carpenter ('36), available in literature only as an abstract) a somewhat similar result was obtained. Samples of 25 to 300 sweeps showed that for the most abundant species the deviation of the individual collection from the mean set by all of the collections was 10 per cent. of that of the total population from a similar mean. The 'abundant' species comprised 91 per cent. of the population in one series of observations and 62 per cent. in the other. The number of individuals obtained with larger numbers of sweeps increased in a manner similar to the Headington Wick observations (Fig. 12). The angle of the curve is in all cases dependent on the population density.)

SUMMARY. This study is a portion of an investigation dealing with the animal population of a grassland area at Headington Wick, Oxford. The value of sweep-net samples is discussed and data is presented from the results obtained by a number of sweepings of different sizes taken at the same time for two habitats. By use of the standard deviation from theoretical and obtained means it was found that the most reliable number of sweeps to obtain a representative sample of the invertebrate population in the vegetation in a *Holcus* community was 75 sweeps, and for a rosette-plant community, 100 sweeps. Personal error was found to be important and not altogether consistent from day to day. The degree to which animals disperse themselves from a random distribution in the vegetation varies under different kinds of weather conditions and differently in different habitats. This method is recommended by the authors as a simple and fairly efficient as well as rapid means of sampling and comparing areas under reconnaisance.

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(Department of Entomology, University Museum, Oxford).

A 47

[*Extracted from the* PROCEEDINGS *of* THE LINNEAN SOCIETY OF LONDON, Session 148, 1935–36, Pt. 2, 27 *March* 1936.]

Evidence that the Growth of the Dead-nettle, Lamium album L., is stimulated by the presence of the Stinging-nettle, Urtica dioica L. By Sir EDWARD B. POULTON, F.R.S.

[PLATE 1]

FOR many years I have taken every opportunity of observing the association between the White Dead-nettle and the Stinging-nettle, and have come to the conclusion that it is

not to be completely explained by the fact that both plants are peculiarly favoured by abundance of nitrates in the soil—the interpretation which, my friend Prof. A. G. Tansley tells me, is the one usually accepted. Such a hypothesis does not explain the characteristic presence of the Dead-nettle in relatively smaller groups of plants ' let in ', as it were, to the borders of Nettle-beds and, less frequently, entirely surrounded by Nettle. And in the relatively few instances in which I have found the Dead-nettle growing apart from the Nettle this has been in places where the latter was close at hand and had probably only recently disappeared from the site of the former, leaving some favourable influence in the earth.

A few observations made in Wensleydale, Yorkshire, September 1934, may be mentioned. At Carperby, where the Stinging-nettle was very plentiful on the broad grassy margins of the road, nearly every patch included the Dead-nettle, at that time (September 20) in flower, while with several the Red Dead-nettle, *Lamium purpureum* L., was closely associated. This latter plant also grew vigorously apart from the Nettle.

At Aysgarth (September 24) the White Dead-nettle was very abundant in patches growing with the Nettle and also separately, but always in spots where it appeared probable that the Nettle had been. The conditions at Bainbridge (September 25) were very similar, but the Dead-nettle was less abundant.

A little higher up Wensleydale, at Hawes, Hardraw, Gayle, and the roads and paths between these two and Hawes, there was a great abundance of Nettle, but I met with not a single example of the White Dead-nettle in several days, and only one plant of the Red Dead-nettle (September 21) near Hardraw. At last I observed (September 23) a fine colony of the White Dead-nettle, in groups between and in two adjacent beds of the Nettle by the road-side between Hawes and Appersett. Much of the Dead-nettle was in flower and the plants were vigorous but not tall—perhaps a young colony, recently established.

A more prolonged and careful search would, of course, provide far more extensive data in the parts of the Dale which I visited, but there can be no doubt that the first-mentioned localities were very favourable to the growth of the Dead-nettle, and that it was in these places associated with the Stinging-nettle; also that, a little higher up the Dale, where the conditions were far less favourable, the same association was found to exist.

I had been first convinced of the probable existence of this association by observations made in walks near Oxford and

in the University Parks, and had reached what appeared to be the probable hypothesis that the Dead-nettle has developed an adaptive response to the stimulus provided by some normal product of the Stinging-nettle. This response and the resulting close association in growth had, it was suggested, been added to the strong superficial likeness which Lubbock * had explained as the direct and simple operation of Natural Selection upon the foliage of the mimicking Dead-nettle. Just as the association in flight between certain mimetic insects and their models requires something more than the development of a likeness—some adaptive response to stimulus, without which the resemblance would lose much of its power to protect, so it seemed probable that the close association in growth between Dead-nettle and Stinging-nettle had developed †.

The hypothesis having suggested itself the supreme necessity was an experimental test, and I vainly tried to induce my botanical friends to undertake this. It was therefore left to me to travel outside my own province and make the attempt myself.

1933, July 2.—Seeds were collected from one plant of *Lamium album*, growing with Nettle outside the Forest Lodge, Bagley Wood, near Oxford. Forty seeds were shaken free on the same day and kept in a chip box in a dry room.

1933, September 21.—A large basket was nearly filled with earth from a nettle-bed in Norham Road, Oxford, and stored in a dry workshop.

1935, July 30.—Twenty of the above-mentioned seeds were sown in a compartment about 9 inches square in the garden of 56 Banbury Road, Oxford, and twenty in a rather larger compartment a few inches to the south of the first. About 350 c.c. of sifted dry earth from the nettle-bed (equal to a large tumblerful) were scattered over the seeds in the first compartment, nothing except the garden soil over those in the second.

1935, September 27.—With the kind help of Mr. A. C. Hoyle, B.Sc., and Mr. F. A. Clinkard, the photographer, of the

* 'Flowers, Fruits and Leaves', Nature Series, Lond. 1886.

'It cannot be doubted that the true Nettle is protected by its power of stinging; and, that being so, it is scarcely less clear that the Dead-nettle must be protected by its likeness to the other. Moreover, ... every one must have observed that the two species are very commonly found growing together '(pp. 128, 129).

'An excellent illustration (Fig. 29, p. 128) shows the resemblance between the two plants in the wild state.'

† A remarkable example of association in both morning and the return evening flight, at Bukit Kutu, Selangor, F.M.S., was recorded by the late Mr. A. R. Sanderson (Proc. Ent. Soc. Lond. 1920, p. lxiii). The three species of Pierine butterflies (*Delias*), three of Geometrid moths (*Dysphania*) and one Chalcosiine moth (*Psaphis*), flying in the migratory stream, are illustrated in *Ibid.* 1921, pl. A, p. v.

Imperial Forestry Institute, Oxford University, the photographs reproduced, about one-sixth of the natural size, in the accompanying Plate, were taken. The smaller left compartment then contained fourteen plants of the Dead-nettle, two being small; the larger right compartment contained eleven plants, all small *. Some of these can only be clearly seen with the aid of a lens.

1935, November 15.—Some of the remaining dry earth from the nettle-bed was examined by Mr. C. G. T. Morison, M.A., Oxford University Reader in Soil Science, who has kindly written the following report:—'The soil has approximately 50 parts per million of Nitric N., which is high, and I think myself that the stimulus is in all probability due to that and to the other similar effects known to be caused by soil which has been dug and kept dry for some time. I think that far more experiments would be required before the improvement in growth could be put down to any specific nettle effect.' This, indeed, was my object in making this simple little experiment—to induce botanists to undertake these researches.

Professor F. E. Weiss expressed his interest in Sir Edward Poulton's experiments, but thought the improved growth of the Dead-nettle might be due to the top dressing of soil, which was probably rich in nitrogenous matter, as the Stinging-nettle favoured a soil rich in nitrogen. A more crucial test would have been to grow both sets of Dead-nettle seedlings in the same soil, but to include growing rhizomes of the stinging nettle in one of them.

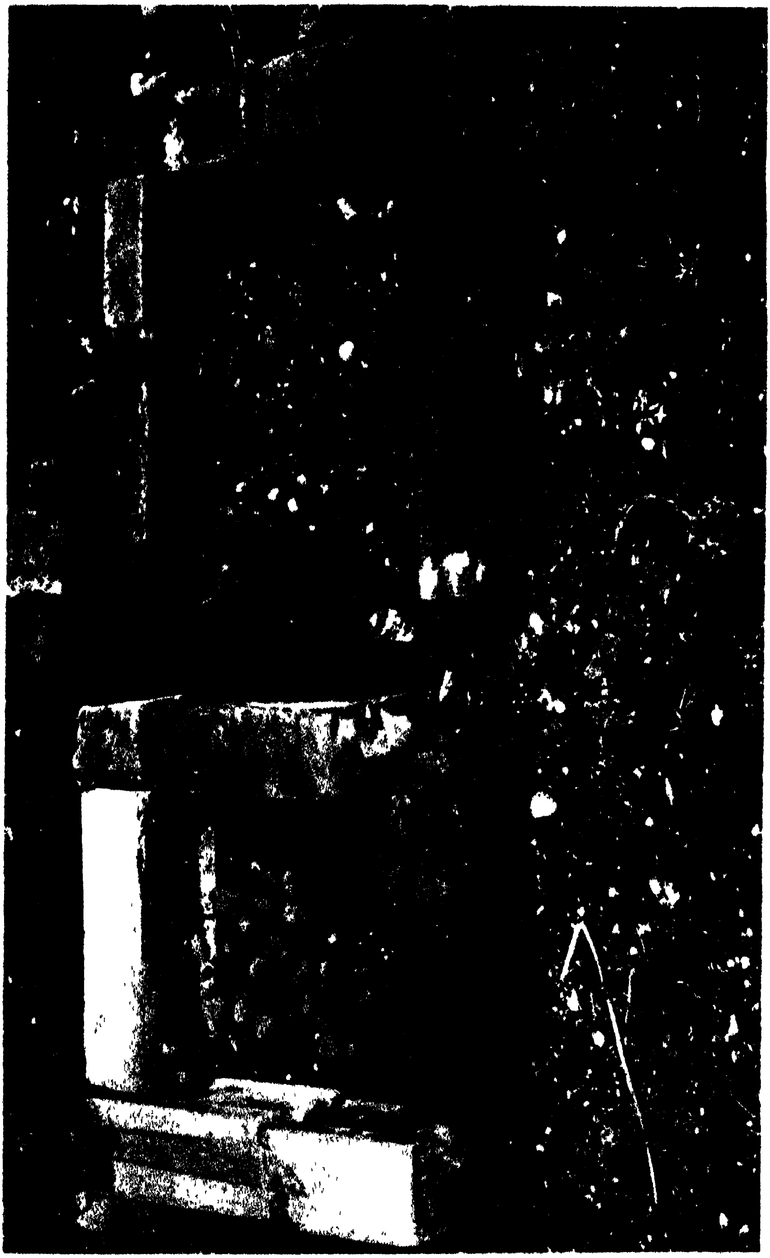
* To-day, 22 February 1936, the plants in the left compartment have grown so much and are so entangled that it is difficult to count them, but I believe that there are twelve. In the other, five plants, still very small, can be seen.—E. B. P.

on so beautiful, so simple, and yet so artificial a contrivance?" There is all the difference in the world between these two, and there is no question which point of view is more fruitful in stimulating enquiry into what was so delightfully called by Charles Kingsley, "Madam How and Lady Why"!

It was the birds and reptiles of the Galapagos Islands to which Darwin devoted most attention: but he says "I took great pains in collecting the insects, but, excepting Tierra del Fuego, I never saw in this respect so poor a country." The insects exemplified the same fact which so impressed him in the case of other animals for "in my very small collection of insects, Mr. Waterhouse remarks, that of those which were ticketed with their locality, not one was common to any two of the islands." His notes on the insects were mainly a brief reference to the dull colours of the few species that occurred there; their "desert" character led him to "conclude that the usual gaudy colouring of the inter-tropical productions, is not related either to the heat or light of those zones, but to some other cause, perhaps to the conditions of existence being generally favourable to life." This very interesting conclusion receives support from the changes of appearance of certain species of butterflies according to whether they are found during the wet or dry season.

In the tropics, just outside the belt of continual equatorial rains, the rainy season alternates with a dry season, the latter being a period of scarcity of insect life when insectivorous animals are hard pressed for food, and consequently the risk of death to any individual insect is greater than in the wet season. Now wet-season butterflies may be quite conspicuously coloured and even have habits that seem to make them conspicuous when insects are in plenty, and there is abundant material to satisfy the hunger of enemies. But the off-spring of a conspicuous wet-season form, which appears in the following dry season, may be very different, and have skulking habits. I think of one in Africa (*Charaxes zoolina*, Westw.) of which the wet-season form is brilliant greenish white with black streaks crossing the wings: the dry-season form is of dead-leaf brown and deliberately hides itself among clusters of dead leaves where it rests unperceived until it is disturbed and flies out.

It was Poulton who pointed out long ago (4) that in times of stress, as in dry season or winter, it is better not to be seen at all than to rely upon other methods for escaping capture; and we



XPERIMENTAL GROW OF HE DEAD-NETTLE

[*Extracted from the* PROCEEDINGS *of* THE LINNEAN SOCIETY OF LONDON, Session 149, 1936–37, Pt. 1, 23 *February* 1937.]

B

Evidence that the Growth of the Dead-nettle, Lamium album L., is stimulated by the presence of the Stinging-nettle, Urtica dioica L.—Further observations. By Sir EDWARD B. POULTON, F.R.S., F.L.S.

[PLATES 1 & 2]

THE results of the little experiment, described and illustrated by pl. 1 in our 'Proceedings' of 27 March 1936, have been kept under observation since the time in September last year when the photograph reproduced in the plate was taken. The contrast between the growth in the two compartments became so striking in the spring and summer that photographs shown in Pls. 1 and 2 were taken on 25 May and 20 August, respectively, efficient help being again kindly rendered by Mr. A. C. Hoyle, B.Sc., and Mr. F. A. Clinkard, of the Imperial Forestry Institute, Oxford University.

1936, *May* 25.—The photograph of this date (Pl. 1) shows a vigorous growth with four flowering stems in the left compartment which had received, on 30 July 1935, about 350 c.c. of dry earth from a nettle-bed, while the plants on the right, although very much larger than in the previous September, are small and immature with leaves very different in form and serration from those on the left. The resemblance of the latter to the leaves of the Stinging-nettle is especially well seen where they appear against the white bricks. The *Lamium* flower-buds had been observed some weeks earlier and on 16 May two open flowers on the stem in the S.E. corner of the compartment—the stem of which the flowering is the most advanced of any shown on Pl. 1.

On May 12 the results were seen by Sir Frederick Keeble, F.R.S., who concluded that the difference between the plants was not caused by the nitrogen of the nettle-bed earth. If it had been so caused, he believed that the leaves on the left would have exhibited a much deeper shade of green.

1936, *July* 12.—Eleven stems in the left compartment bore white buds or flowers. The most advanced of these had fallen and calyces were collected and dried in the hope that fertile seed had developed. In the right compartment the plants showed much growth, but with leaves immature

and less nettle-like than those on the left. The five tallest stems were from 5 to 6½ in. in height. About five plants, one being very small, could be distinguished with some uncertainty because of the entanglement and the difficulty in deciding whether certain small low shoots belonged to any of the above five or were additional plants.

1936, *August* 20.—The photograph taken this day and reproduced on Pl. 2 shows that the flowers had mostly fallen, the calyces being clearly visible on one of the stems near the centre of the group and on another covering the tip of a fern-leaf outside the compartment. The plants in the right compartment are seen to have grown immensely since May 25, but still retain the immature more rounded leaves and show no trace of flower-buds or flowers.

The presence of a factor specially favourable to growth in the left compartment may be suggested by the grating shown in Pls. 1 and 2, together with the rain-water pipe which appears in the latter. Any such conclusion would, however, be mistaken. The enclosing bricks are cemented in place and the floor of the chamber, also cemented, slopes towards the grating. The gulley-trap below was not choked with dead leaves &c. so that the rain-water would rise and overflow. Its depth in the trap is about 8½ in. and its surface about 7½ in. below the level of the earth in both compartments, while the trap itself is oriented towards the right-hand one, under which the overflow-pipe runs. Furthermore, about 13 in. to the left of the bricks enclosing the left compartment is the nearly vertical, rough stone end-wall of a dry area about 5 ft. 6 in. deep. It is unfortunate that, of several pairs of compartments in which the seeds of *Lamium* were sown, successful germination should have occurred only in this pair, but I believe it has been shown that the difference in growth cannot be attributed to the rain-water discharged over the grating.

1936, *October* 17.—The tallest stems were 13 to 14 in. high in the left compartment, 9 in. in the right. Four flowering stems were noted in the former and many calyces were gathered in the hope of seed. Although still immature, the plants on the right were apparently vigorous and had grown considerably, while two shoots had pushed their way under the right bricks (on the south side) and were growing outside the enclosure.

1936, *October* 28.—A nearly prostrate stem in the left compartment was about 1 ft. 10 in. long and at least 2 ft. if stretched. Of its 10 whorls the flowers had fallen from the lower half, while the upper still bore buds or flowers, also to be seen on another stem and its branch. The little shoots outside the right compartment were about 3 in. high.

My friend Prof. A. G. Tansley, F.R.S., has kindly examined the seeds and reports that 'none were viable. Of the batch marked July 12 not one had even formed an embryo; of the October 17 batch, one, and one only, had a fully formed embryo, but it was dead'.

It is probable that the little patch of *Lamium* in an enclosure only 9 in. square had been passed over by the humble-bees which would have brought about cross-fertilization.

The contrast between the plants of the right and left side, shown in pl. 1 of Proc. Linn. Soc., 148 Sess., 1935–36, and in the two Plates of this paper, is so great and has persisted for so long a time that the influence of a living organism, of which the germs were introduced with the nettle-bed soil, is suggested—a possible conclusion pointed out to me by Mr. Ray Bourne, Demonstrator in the Imperial Forestry Institute, Oxford University, who has kindly directed my attention to the apparently analogous effect produced by mycorrhizal fungi upon seedlings of *Pinus* as shown by the experiments of Dr. M. C. Rayner and others *.

Friends who have read the earlier paper on this subject have kindly written of their experiences, especially valuable when gained by Hymenopterists who have been interested in the visits of Humble-bees to the flowers of *Lamium*.

Dr. R. C. L. Perkins, F.R.S., writing on 27 May 1936 from Newton Abbot, contributed the following interesting notes:—

'White dead-nettle is quite rare here, and I have not seen the Red one at all. I only know two spots where *L. album* grows near me—though of course there must be others. One is on a waste patch of land by the canal half a mile from the house, and I have seen this patch every year for fully 10 years. On many occasions I have visited it to pick the fresh growth in April (or even March) as food for the hibernated larvae of the two tiger-moths, *Callimorpha hera* L. and *C. dominula* L. I also use it for them in the autumn when they

* M. C. Rayner, 'Mycorrhiza, an account of non-pathogenic infection by fungi in vascular plants and Bryophytes', 'New Phytologist Reprint', no. 15, 1927.

'Empire Forestry Journal', ix. 1930, pp. 182–9; Brit. Assoc., Sect. K, 1930, 1931, 1932, Repts. of Comm. on *Mycorhiza* drawn up by M. C. R.; 'Forestry', viii, no. 2, 1934, pp. 96–125, pls. v–xiii; x, no. 1, 1936, pp. 1–22, pls. i–vi.

S. L. Kessell, Conservator of Forests, Western Australia, 'Empire Forestry Journal', vi, no. 1, 1927, pp. 70–4, figs. 1–3.

E. J. Kelly Edwards, Acting Chief Forest Officer, S. Rhodesia, Rept. Dept. Agric. S. Rhodesia, 1930, p. 53.

J. B. Clements, Conservator of Forests, Rept. For. Dept., Nyasaland, 1934, p. 17.

D. A. N. Cromer, B.Sc., Commonwealth For. Bureau, Bull. no. 16, Canberra, 1935, pp. 1–19, pls. 1–6, figs. 1–3.

first hatch and until they hibernate. It is an admirable food, as it produces large moths and without bringing disease to the larvae. I have never yet picked this food without getting well stung on the hands by the true nettles with which it is mixed. There are many clumps of nettles on this waste land, but only the one of dead-nettle. I have just been down to look at the place. The nettle and *Lamium* are well mixed and anyone long-sighted like myself and not wearing glasses out of doors would be certain to be stung in picking the latter. The patch is about 9 yds. long, of a curved form with a tendency to spread on one side.

'I seem to remember that *Lamium* used to be distributed all over the place alongside hedges &c. in Oxford and in the Cotswold district. In both these areas in the spring I used to look for the big queens of *Bombus latreillellus* on the flowers, and those of *B. derhamellus* (using the old names of E. Saunders) were abundant. The former is very rare here, the latter uncommon, and it is curious that the only ♀ of *latreillellus* I have seen here, I caught on that waste land and I notice a ♀ *derhamellus* there most years. It would be too much to say they were there because of the *Lamium*, as they are not at all confined to it in the spring.

'The other patch of dead-nettle is about ¼ mile from the one mentioned, but with the river Teign between and less accessible, so I have seen it only infrequently. It has now disappeared and I cannot remember whether it was associated with stinging-nettle.'

Dr. O. W. Richards, D.Sc., wrote 10 May 1936 on the same subject :—

"It is certainly a very interesting problem. I have always been observant of *Lamium album* because it is the flower most attractive to *Bombus*. My experience is the same as yours, that it always occurs amongst or near nettles."

Two friends have also brought evidence that the dead-nettle, when found apart from the stinging-nettle, is growing in places where the latter has recently existed.

Mrs. D. R. Fyson, of Laugherne House, Rushwick, Worcester, wrote on 20 May 1936 :—

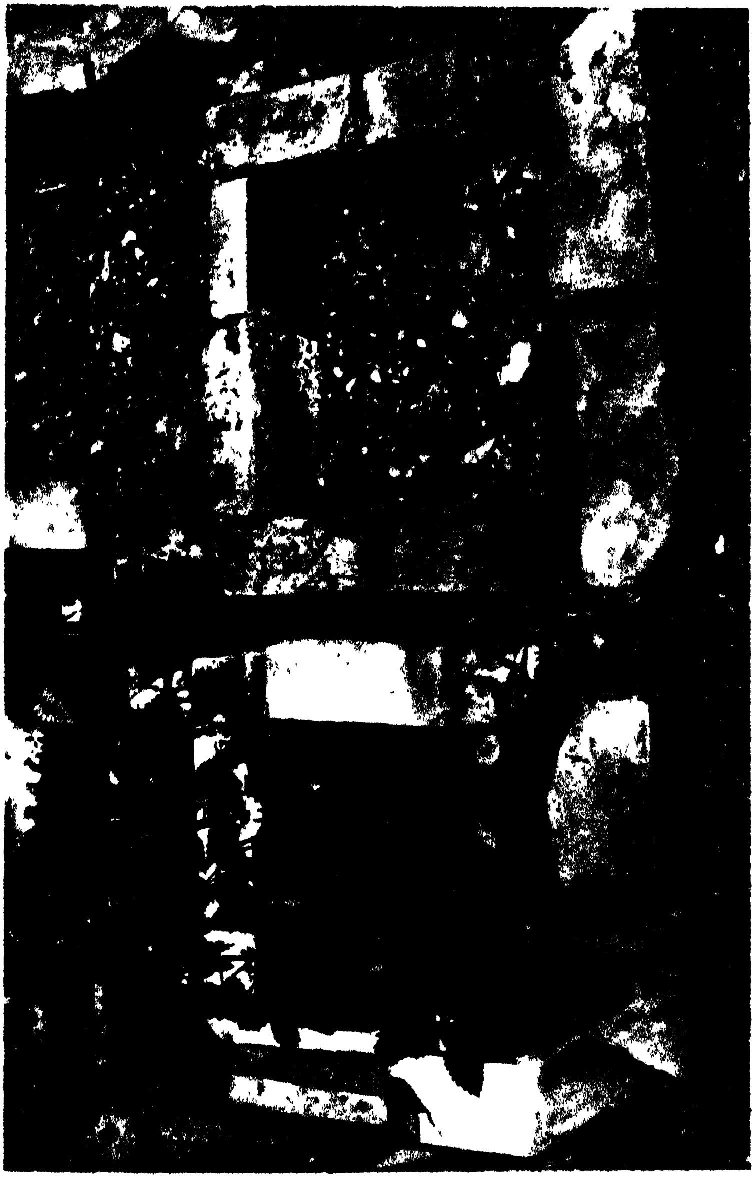
"Such evidence as our garden affords bears out your theory. The place was neglected when we took it, four years ago, and one of the first tasks was to root out nettles. On the site of the chief nettle-beds there are now prosperous clumps of dead-nettle, whose white flowers are so fine that I leave them undisturbed where they do not interfere much with other plants."

Mrs. F. Ll. Griffith, of Sandridge, Boars Hill, Oxford, has also informed me that her experience of *Lamium* in the

garden of Sandridge, where stinging nettles had recently flourished, is precisely the same as that of Mrs. Fyson.

Professor F. E. Weiss expressed his appreciation of Sir Edward Poulton's experiments and his interest in the results obtained. He thought the soil from the bed of nettles which had been added to one of the plots might in some way have enriched the plot. He had therefore started an experiment in which two plots containing the same soil had been sown with seeds of *Lamium album*. In one of the two, however, he had planted rhizomes of the stinging-nettle in order to see what influence, if any, it might exert upon the seedlings of the dead-nettle.

Mr. I. H. Burkill referred to the very rapid recovery of fertility in a seed-bed after partial sterilization by fire, and asked if it were not possible to explain the success of the dead-nettle plants on the soil inoculated from the stinging-nettle patch as the work of a somewhat selected soil fauna on a soil which was sterile at the beginning of the experiment.



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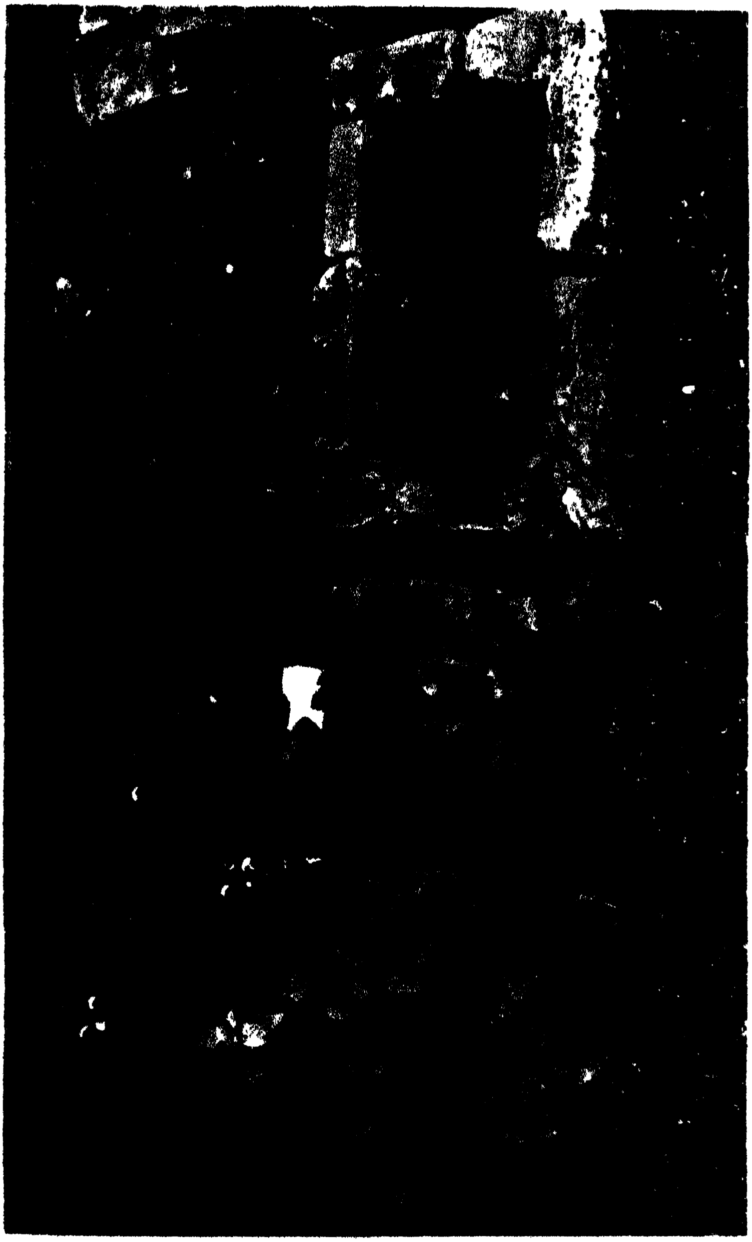
EXPERIMENTAL GROWTH OF THE DEAD-NETTLE
25TH MAY, 1936.

find that facts are in accordance with what the theory of natural selection demands.

It is difficult to frame another explanation for the fact that the appearance and instincts of a species are changed according to whether the climate in which it appears, in the final stage of its life, is wet or dry. Note that the perfect butterfly which appears in the wet season is the product of the dry season during which its caterpillar lived and fed, and *vice versa.* Any explanation which attributes the appearance of the perfect insect to its environment is faced with the difficulty that the appearance in harmony with any one season is due to the effect of totally different conditions during the larval period when the appearance of the future perfect insect is being prepared.

Thus we have the unexpected fact that the dry-season butterfly, appearing under conditions of greater stress, is larger than the wet-season form, because its larva fed under better conditions than the larva which feeds in the unfavourable dry season to produce the wet-season form of butterfly.

Let us return again to Galapagos for a further interesting note by Darwin. In a letter to Professor Meldola in 1872 (5) he writes of "a strange speculation . . . . about the appreciations of certain colours being developed in those species which frequently behold other forms similarly ornamented . . . . Similar ideas have passed through my mind when considering the dull colours of all the organisms which inhabit dull-coloured regions, such as Patagonia and the Galapagos Is." Possibly these ideas were derived from his grandfather's famous work "Zoonomia" written by Erasmus Darwin in 1794, and from notes in the earlier work "Botanic Garden." In 1791 in footnotes to the latter Erasmus gave many examples of protective coloration (6), even drawing attention to the light-coloured bellies of birds which render them difficult to see against the sky, and pointing out that fish similarly have pale bellies and dark backs. He also comments on animals becoming white in colder climates during the snows, and writes that "the final cause of these colours is easily understood as they serve some purpose, but the efficient cause would seem almost beyond conjecture." An explanation is suggested as follows. All animals may possess a tendency to be coloured somewhat like the colours they most frequently inspect. There is reciprocity between the central perceiving organ and the peripheral sense organ, so that if the retina is so arranged as to perceive white "the extremities of



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EXPERIMENTAL GROWTH OF THE DEAD-NETTLE
20TH AUGUST, 1936.

48
ARKIV FÖR ZOOLOGI.
BAND 30 B. N:o 5.

Die Arthropodenfauna von Madeira nach den Ergebnissen der Reise von Prof. Dr. O. Lundblad Juli—August 1935.

VI. Blattaria.

Von

R. HANITSCH.

Mitgeteilt am 12. Januar 1938 durch Y. SJÖSTEDT.

1 Hololampra infumata (BRUNNER)

1858. *Blatta ericetorum* WOLLASTON. — Ann. Mag. Nat. Hist. (3), Vol. 1, p. 21. (Madeira).
1865. *Aphlebia infumata* BR. — Nouv. Syst. Blatt. p. 68 (♂ Madeira).
1904. *Hololampra infumata* KIRBY. — Syn Cat. Orth., Vol. I, p. 69.

Localities: Rabaçal, 1080 m. — 17 ♂♂, 20 ♀♀, July 17th to Aug. 4th 1935. — Caramujo, 1250 m., 7 ♂♂, 11 ♀♀, Aug. 6th to Aug. 16th 1935.

Distribution: Madeira.

Some of the specimens were labelled as having been taken under stones, a few in the *Erica* forest. WOLLASTON (l. c.) says: »Inhabits Madeira proper, occurring principally beneath the loose outer fibre of the gigantic Heath-trees, on the upper limits of the sylvan districts, — from about 4500 to 5000 feet above the sea».

BRUNNER selected a new specific name, as *ericetorum* had already been applied to a species of *Ectobius*, viz. *E. ericetorum* WESMAËL.

2. Loboptera decipiens (GERMAR).

1817. *Blatta decipiens* GERMAR. — Reise nach Dalmatien, p. 249. No. 314 (Dalmatia).
1865. *Loboptera decipiens* BRUNNER. — Nouv. Syst. Blatt., p. 80, pl. II, fig. 5.

Localities: Machico, 2 ♂♂, 2 ♀♀, July 12th 1935. — Feiteiras, 1 ♂, Aug. 15th 1935. — Madeira, Monte, under stones, 6 ♀♀, Aug. 21st 1935.

Distribution: BRUNNER, l. c., p. 81, gives its distribution as Dalmatia, Carnolia, Corsica, Sardinia, Spain, Madeira, Greece and Turkey. Kirby adds Asia Minor. The Oxford University Museum has examples from Dalmatia, from Barcelona and Majorca (E. B. POULTON, 1900), Majorca (A. H. HAMM and W. HOLLAND, 1901), Minorca (E. S. GOODRICH, 1900) and Algiers (G. B. LONGSTAFF, 1905).

3. **Periplaneta americana** L.

Locality: Funchal, 2 ♂♂, July 11th to 15th 1935.

Distribution: Cosmopolitan.

4. **Blatta orientalis** L.

Localities: Estrella Calheta, 1 ♀, Aug. 3rd 1935. Funchal, 1 ♀, Aug. 20th 1935.

Distribution: Cosmopolitan.

Tryckt den 21 februari 1938.

Uppsala 1938. Almqvist & Wiksells Boktryckeri-A.-B.

No. 378 JUNE 15, 1938

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REDESCRIPTION OF THE TYPES OF *PROTONEURA TENUIS* SELYS AND A STUDY OF VARIATION IN THIS SPECIES

BY J. COWLEY AND LEONORA K. GLOYD*

UP to the present time our knowledge of *Protoneura tenuis* has been restricted to the three specimens seen and described by Selys. As his original diagnosis is extremely laconic, it is very doubtful whether the species could be identified without a re-examination of the types in the collection of J. C. Dale, now in the Oxford University Museum. Dr. B. M. Hobby kindly searched for these types among the exotic Odonata of the Dale collection; the only specimens with the specific name *tenuis* proved to be five specimens under the name *"Argyia tenuis,"* and the senior author has been privileged to examine these through the courtesy of Professor G. D. Hale Carpenter. These five specimens and their pin labels are as follows (none of them is explicitly indicated as being the type):

1) "♂ Para χ / 1850" and on underside "♂" (in pencil); is a male *Protoneura*.

* The senior author initiated this study and is responsible for the description and drawings of the holotype and allotype of *P. tenuis* in the Dale collection, Oxford University Museum; the junior author is responsible for that part of the paper and drawings relative to the series of *tenuis* and *calverti* in the Williamson collection, Museum of Zoology, University of Michigan.

2) "♀ Para χ / 1850" and on underside "♀" (in pencil); is a female *Protoneura.*
3) "Ent Club" (in ink; no locality); is a male *Metaleptobasis manicaria* Williamson.
4) "Para / 1850" (in pencil); is a male *Metaleptobasis mauritia* Williamson.
5) "Para / 1848" (in ink); is a female *Metaleptobasis* sp.

There is in addition a printed label "Para" not attached to any specimen.

Selys (1860) cites the name *tenuis* as "Dale MS."; from his remarks in 1869[1] it is evident that the Dale collection contained specimens taken by Bates, and possibly the above five among them (with more doubt as to specimen No. 3, the label indicating that it was presented by the Entomological Club). Selys in 1886 explicitly states that the types of *tenuis* were one male and one female ("le couple-type"), and there can be no doubt that specimens Nos. 1 and 2 are these types, for Nos. 3–5 have not even any outward resemblance to Protoneurines and could not have been included by Selys in his *tenuis.* Dr. Hobby states that no alterations in the arrangement of the Dale exotic Odonata have been made since its acquisition by the Oxford Museum, and he suggests that specimens Nos. 3–5 may have come to be under the name *tenuis* during some rearrangement made by C. W. Dale after the death of his father, J. C. Dale. The "χ" on the labels of Nos. 1 and 2 may perhaps indicate that they are types. The original diagnosis (quoted below), so far as it goes, agrees with specimens Nos. 1 and 2, but it would apply almost equally well to several species of *Protoneura* (*sens. lat.*). The specimens have now been labeled to indicate which of them are the types.

The third specimen described by Selys (1886) from his own collection is of course not a type; he referred it to *tenuis* with some doubt, and Ris (in Williamson, 1915) reported that "it is a very miserable teneral male specimen . . . I can not without a microscope be sure of the appendages in their bad condition." From Selys' description it is not possible to decide

[1] *Bull. acad. belg.*, (2), 27: 646, footnote on Bates's MS. names.

whether this teneral male is *tenuis* or some other species, but we may note that the size (abd. 26, hind wing 16 mm.) is smaller than that of the male type. We have not seen this specimen, as in its bad condition it would probably provide but little information of any value, although it would be as well at some future date that it be examined so that the reference to Selys (1886) may be listed under the correct species.

Williamson (1915) suggested that *tenuis,* which he had not seen, might be a *Protoneura* (*sens. str.*) or more probably an *Epipleoneura*; a study of the types shows that *tenuis* is a *Protoneura* (*sens. str.*) closely related to *P. calverti* Williamson.

PROTONEURA TENUIS SELYS, 1860

Protoneura tenuis Selys, 1860, *Bull. acad. belg.*, (2), 10: 461–62, diagnosis ♂ ♀, Pará, in Dale collection.

Hagen, 1861, *Syn. Neuropt. N. Amer.*, p. 310, listed, Pará.

Protoneura tenuis? Selys, 1886, *Mem. cour. acad. belg.*, 38 (4): 210–11, desc. ♂ juv., Obidos, Amazons (in Selys collection); original diagnosis quoted, "Le couple-type. Coll. Dale."

Protoneura tenuis Kirby, 1890, *Syn. Cat. Neuropt. Odon.*, p. 136, listed, Amazons.

Epipleoneura? tenuis Williamson, 1915, *Proc. U. S. Nat. Mus.*, 48: 619, 627, notes on generic position and ♂ juv. of Selys, 1886.

Original diagnosis: "Taille: environ celle de la *capillaris.* i.e. Abdomen environ 25, aile inférieure 17, large de 2½. Troisième segment de l'abdomen noir violet. ♂ Thorax noir, avec deux bandes antéhumérales rousses. ♀ Thorax avec trois lignes latérales, dont une antéhumérale ?, jaunes."

Male Holotype, Pará

Head (Pl. II, Figs. 1–2).—Labium pale cream, the median lobe cleft to slightly less than half its length; labrum shining black, anteriorly narrowly bordered with yellow; bases of mandibles black and yellow, the black basal and of greater extent, following the outline of the labrum and clypeus and thus narrowly separated from them by yellow; anteclypeus brown with yellow area between each anterior angle and the labrum; postclypeus black; frons rounded, almost angulate but not ridged, the two faces at an angle somewhat greater than

ninety degrees, the anterior face shining black with a pair of dull yellow spots shaped like a triangle with rounded angles, separated by a distance less than the width of the median ocellus, extending laterally to the level of the outer edge of the lateral ocellus; at the base of each antenna and anterior to it is a smaller, subtriangular, dull, yellow spot, thus forming a line of four spots across the head; dorsal surface of frons and vertex matt black with slight metallic reflections and a scaly appearance; genae yellow, the boundary between this and the dorsal black extends from the basal angle of the postclypeus to the eye anterior to the antennae in a curved line, the yellow being convex; antennae black, exteriorly pale yellow apically on the scape and basally on the pedicel, the latter becoming dark brown apically, the flagellum dark brown; rear of head matt black; eyes brown.

PROTHORAX.—Black, the median lobe with a pair of large subquadrangular dorsal orange spots covering the greater part and narrowly separated middorsally; pleuron black (Pl. II, Figs. 3–5). Posterior lobe somewhat erect, in anterodorsal view the posterior border evenly rounded, very slightly concave medially, the pleuron slightly angulate at the lateral margins of the posterior lobe.

PTEROTHORAX (Pl. II, Fig. 7).—Mesepisternum black with a pair of subtriangular orange stripes separated middorsally, these stripes reaching the mesopleural or humeral suture for some distance below, narrowing above, about half the width of the mesepisternum at midheight, the apex rounded and not quite reaching the antealar sinus, interiorly parallel to the dorsal carina, exteriorly slightly concave; a minute yellow spot below the wing; mesinfraepisternum black; mesepimeron black, the black extending on the metepisternum, which is black above, largely pale yellow below, the yellow forming a stripe which is broadest at the level of the metastigma—but narrower than the combined mesepimeral and metepisternal black—where it reaches the metapleural suture, narrowed above and not reaching the dorsal end of the metepisternum, its anterior edge parallel to the interpleural suture, the greater part of the

dorsal marginal carina and a minute spot below the wing yellow; metepimeron largely pale yellow but invaded by the metepisternal black above, where it curves round to form a dorsal black margin, and below where it broadens to pass on to the metinfraepisternum, which is black above, shading to pale yellow below; there is thus a black stripe of approximately even width over the metapleural suture; venter pale yellow with a pair of black spots anteriorly and two pairs of obscure brownish spots posteriorly; nota black with central yellow spots, wing bases brown to pale yellow.

Legs.—Second and third wanting, first with coxa pale yellow, anteriorly obscurely brown at the base; trochanters pale yellow; femur anterodorsally black, ventrally and posterodorsally pale yellow for about the basal two-thirds, the apical third black; tibia and tarsus black to dark brown, claws dark brown, spines black to dark brown (Pl. II, Fig. 6).

Wings.—Hyaline, venation black to dark brown, pterostigma black and about twice as long as wide, covering slightly less than 1 cell. Postnodals, front wing, 10, hind wing, 8–9; postsubnodals, front wing, 9–10, hind wing, 8; superior sector of triangle in hind wing ending at subnodal transversal; median sector arises half a cell before subnodus, subnodal sector arises at subnodus; nodal sector arises front wing at fifth, hind wing at fourth postsubnodal; postnodal sector arises front wing at ninth, hind wing at eighth; subnodal sector ends distal to level of pterostigma; lower sector of arculus ends front wing at level of proximal end of pterostigma, hind wing at level of proximal end of pterostigma or half a cell proximal to it; first antenodal costal space distinctly longest, second and third subequal, together slightly longer than first; second antenodal proximal to arculus by about the length of arculus; cubito-anal cross vein distal to first antenodal front wing 1/6–1/4 of second antenodal costal space, hind wing less than 1/8 or about 1/4; subnodal and median sectors just distinct—1 front wing—or joined at subnodal transversal; the width of the wings about 1/8 of the length; distance base to nodus about or just over 1/3 of the

wing length and equaling the distance from the nodus to the sixth postnodal or just proximal to it.

ABDOMEN (Plate II, Fig. 8).—Slender, widened at segment 8, which has a broad sternite; black, 3–6 with a very fine median longitudinal brown line which almost reaches the base and apex of each segment; 1 and 2 pale bluish yellow laterally, but not extending to the base or apex of the segment, on 1 occupying about the ventral two-thirds, on 2 at its widest occupying about the ventral half; 3–7 with a basal ring, on 3 blue, interrupted middorsally, tending to yellow laterally, reaching the ventral margin of the segment and extending apically along it for a short distance; on 4 a deeper blue, more narrowly interrupted middorsally and not reaching the ventral margin, thus forming a pair of small median spots; on 5 similar, but the two spots almost confluent medially; on 6 not interrupted middorsally, narrow, pale yellow, not reaching the ventral margin, and with a pair of obscure deep blue median spots apical and contiguous to it, the spots almost meeting middorsally; on 7 a pale yellow broader ring, not interrupted middorsally, and not reaching the ventral margin; 3–6 with the black shading to brown and yellow laterally, the yellow forming a very narrow ventral stripe which on 3 is a continuation of the basal ring, on 4–6 not reaching the base or the apex of the segment, on 4 confined to the subbasal part of the segment, on 5 extending to about the basal half of the length, and on 6 extending the greater length of the segment; 7–9 laterally yellow, on 7 very narrow and more brown basally, becoming wider and more yellow apically, at the apex occupying about the ventral sixth, on 8 more extensive, becoming wider subapically and then slightly narrowed again, occupying about the ventral quarter at its greatest width, on 9 forming a spot at the basal ventral angle of about the width of the lateral yellow at the apex of 8, and extending for slightly less than the basal third of the segment, with, just caudal and dorsal to this spot, a small ill-defined yellowish brown spot; 10 entirely black; 9 and 10 shining black dorsally; sternites of 1 and 2 pale yellow, hamules

the nerves of touch in the rete mucosum of the skin may be induced into similar action, and the skin or feathers or hair may in like manner so dispose their extreme fibres as to reflect white."

There is a very interesting footnote in the "Botanic Garden," part 2, pages 7-8, which is aptly noticed in this part of my address. For from it Charles may have received an idea which helped him, perhaps unconsciously, to develop his thesis: it concerns the peculiar little structures seen on two-winged flies behind the wings, and known as "Halteres" or "Balancers." Erasmus wrote of these vestiges of former wings and other analogous structures "other animals have marks of having in a long process of time undergone changes in some parts of their bodies, which may have been effected to accommodate them to new ways of procuring their food . . . . Perhaps all the productions of nature are in their progress to a greater perfection."

We have now obtained some conception of the influence which insects had upon Charles Darwin's gradually developing ideas, but there is one aspect which I do not intend to consider, except in passing, as it concerns a less important subject. You will remember Darwin's pet theory of Sexual Selection, but may perhaps have forgotten what a large part insects played in the setting forth of that theory in the "Descent of Man." In a review of the subject of the Courtship of insects by O. W. Richards (7) and in an address which I gave last year (8) dealing with later publications on the same subject you will find much information and a very able discussion by Dr. Richards.

Let us pass on to the major part of my address, namely the influence which Darwin had upon the study of insects, and, in particular, the influence of the doctrine of natural selection upon our understanding of the meaning of the coloration of insects. Particularly important are the colours that seem to make the wearer more conspicuous than we think it ought to be in order to avoid its enemies.

The anthropocentric conceptions of pre-Darwinian days explained such coloration in a variety of ways and often in very amusing terms, and we will look at some of the views of observers of those days. Coloration for the purpose of concealment of course raised no difficulty at all—it was simply a means by which a beneficent Creator arranged that insects thus coloured could avoid being eaten. Why certain insects should have been thus favoured above others,

dark brown, of 3–7 dark brown, of 8 very dark brown with the apical quarter pale yellow, of 9 pale yellow, of 10 brown.

PENIS (Pl. I, Figs. 4–5).—Shaft-spines absent; internal fold apparently absent, but perhaps represented by a small fold beneath the base of the third segment; third segment large, produced into a lobe on each side, the lobe curved ventrad and then dorsad, hence convex in ventral view.

ABDOMINAL APPENDAGES (Pl. I, Figs. 1–3).—Superiors black, brown medially and ventrally, subequal in length to segment 10, slightly shorter than the inferiors, in dorsal view broader at the base, subbasally widened internally and the surface slightly concave exterodorsally, then tapered to the rounded apex, exteriorly slightly convex; in a slightly more lateral view the inferiors appear exterior to the superiors; in dorsointernal view with a ventral laminar swelling occupying about the middle third of the length; in lateral view moderately concave dorsally, the apex narrowed and directed ventrad and slightly mesad, the ventral swelling well marked; inferiors dark brown, subcylindrical, in lateral view broad basally, then abruptly narrowed and subcylindrical to the slightly dorsally directed apex.

Apical margin of segment 10 with a middorsal V-shaped excision, ventral to which is a small rounded black supra-anal tubercle—probably homologous with the supra-anal plates of *Epipleoneura lamina* and *E. incusa*.

Abdomen + appendages, 32, hind wing, 18, costal length pt. hind wing, 0.60–0.65 mm.

FEMALE ALLOTYPE, PARÁ

HEAD.—As in male, but the pale spots bright yellow, the mandible bases without yellow outlining the lateral edges of the labrum and the black not extending so far laterally on the genae (Pl. III, Fig. 7).

PROTHORAX (Pl. III, Figs. 4–6).—Black with a pair of bright yellow stripes extending from the sides of the anterior over the median to the sides of the posterior lobe; pleuron angulate as in male, black, the extreme ventral angle dull yellow; posterior lobe erect, in anterodorsal view the posterior margin straight middorsally, in dorsal view the posterior margin with a slightly

convex projection middorsally, which in caudal and lateral views is seen to be due to a ridge running parallel to the posterior margin on the ventral surface of the lobe.

PTEROTHORAX (Pl. III, Fig. 10).—Mesepisternum and mesepimeron black, the middorsal carina narrowly yellow, a narrow yellow stripe against the mesopleural suture and anterior to it, extending along about the basal 3/4 of the mesepisternum, posterior to the suture a short stripe beginning just below the end of the previous stripe and extending dorsally, not reaching the dorsal margin; the lower third of the mesostigmal lamina yellow and a yellow spot below the wing; mesinfraepisternum black, the posterior angle narrowly yellow; metepisternum and metepimeron pale yellow with a black stripe over the metapleural suture which widens above on the metepisternum and joins the mesepimeral black just anterior to the wing base; apical carina of metepisternum yellow; metinfraepisternum with about the anterior half black, the posterior half yellow; venter yellow with a pair of dark brown spots posterior to the third coxae and a pair of ill-defined pale brown spots farther caudad; nota black, yellow centrally, wing bases brown.

LEGS (Pl. III, Fig. 8).—Coxae yellow, the second and third brown at the base anteriorly; femora pale yellow, about the apical, 1/3, 3/8, and 3/10 of the first, second, and third respectively, black; tibiae, tarsi, and spines black, claws dark brown.

WINGS.—Pterostigma dark brown, the encircling veins black; postnodals front wing, 10, hind wing, 9; postsubnodals front wing, 9, hind wings, 8; superior sector of triangle crossing the subnodal transversal and ending on the wing margin slightly distad—in right front wing practically coalesced with the transversal, but nevertheless it can be seen that they actually do cross; postnodal sector arises front wing at eighth, hind wing at seventh or eighth postsubnodal; lower sector of arculus ending front wing half a cell proximal to pterostigma or beneath the middle of pterostigma, hind wing at proximal end of pterostigma; second antenodal costal space relatively shorter than in male, the first distinctly the longest, third slightly—about 1 1/4 times—longer than second, together rather longer than first; cubito-anal cross vein distal to first antenodal front

wing, 1/3 or 1/4 of second antenodal costal space, hind wing, 1/4; the rest of the venation as in the male.

ABDOMEN (Pl. III, Fig. 12).—Black, the following yellow: segments 1 and 2 lateroventrally, basal rings, interrupted middorsally, on 3–5, a pair of basal dorsal spots on 6 and 7, smaller on 7, 3–7 narrowly lateroventrally, lateroventral spots on 8 and 9, triangular on 8, rounded and apical on 9; sternites black, the following yellow: of 1, apical half of 2, apex of 7 narrowly, a pair of basal spots and the apical third of 8 and the black of 8 medially with a subapical triangular projection.

ABDOMINAL APPENDAGES.—Black, shorter than 10; ovipositor yellow above, brown below, the valves reaching the level of the apex of the anal appendage (Pl. III, Figs. 1–3).

Abdomen + appendages, 26.5, hind wing, 18, costal length pt. hind wing, 0.60 mm.

The following data on a rather large series of *Protoneura tenuis* in the Williamson collection, Museum of Zoology, University of Michigan, show the variation within a single species and indicate to a certain degree the reliability of generic characters which have been used for Protoneurines.

Material examined, 43 ♂, 21 ♀: BRAZIL: Porto Velho, Amazonas, February 13 (2 ♂ 2 ♀), 17 (3 ♂ 1 ♀), 21 (5 ♂ 3 ♀), 22 (2 ♂ 1 ♀), and 27 (1 ♂ 1 ♀, pair), and May 3 (1 ♂), 4 (2 ♂ 1 ♀), 18 (1 ♂), and 24 (1 ♀); Villa Murtinho, Matto Grosso, April 1 (2 ♂), 3 (1 ♂), 4 (5 ♂ 2 ♀), 6 (1 ♂ 1 ♀), and 7 (1 ♂); Belem, Pará, August 7 (3 ♂ 2 ♀), 8 (6 ♂ 1 ♀), and 14 (4 ♂ 2 ♀). BOLIVIA: Río Beni, Cashuela Esperanza, Provincia de Vaca Diez, April 10 (2 ♂), 11 (1 ♂ 1 ♀), and 13 (2 ♀). All were collected by J. H. Williamson and J. W. Strohm in 1922.

MALE

HEAD.—The coloration is the same as in the type except in regard to the series of 4 spots across the anterior face of the frons. These spots are of approximately equal size in 20 specimens (very obscure in 3); the median pair are larger, as in the type, in 20 (obscure in 2), very small with the distance between greater than the width of the median ocellus in 2, and absent

in 1. In living specimens the spots of the frons are yellowish green and the eyes are very dark brown above and light green below.

PROTHORAX.—Typical in all 43 males.

PTEROTHORAX.—According to the color notes made by Mr. Jesse H. Williamson the dorsal areas are red, the lateral pale areas almost white with a greenish cast, and the underparts all white, in life. In the dried specimens of this most excellently preserved series the dorsal spots are scarlet or bright orange, the lateral areas bluish white with pale yellow tints and the underparts a creamy white. The color pattern is essentially the same in all the males, but the extent of certain black areas varies (Pl. II, Fig. 7, Pl. IV, Figs. 1–5). Grouped roughly, there are 15 different combinations of the pattern elements as recorded in Table I.

TABLE I

T as in holotype, Pl. II, Fig. 7; I, II, III, and V, as in Pl. IV, Figs. 1, 2, 3, and 5, respectively

Number of Specimens	Dorsal Red Area	Extension on Humeral	Mesepimeral Pale Stripe
6	T	T	T
11 (Fig. 1)	I	I	I
7	T	III	T
3 (Fig. 3)	III	III	T
2	T	I	T
2	T	III	I
2	I	III	T
2	III	III	I
1	T	I	I
1 (Fig. 2)	T	II	I
1	I	I	T
1	I	T	T
1	III	I	T
1 (Fig. 4)	III	I	I
1 (Fig. 5)	V	I and V	I

LEGS (Pl. IV, Fig. 6).—Coxae very pale yellow or cream, brown at base. Trochanters cream, the lower portion of the first pair sometimes with a brown triangular area on the antero-dorsal surface. Femur of first pair anterodorsally black except for a pale basal area (the base sometimes narrowly marked

with black or obscure brown), ventrally and posterodorsally cream for slightly more than the basal half, the pale area divided by a narrow grayish band, apical portion black or very dark brown; second and third pair with apical 1/3 or 2/5 and 1/4 respectively, black; the basal cream area with an obscure grayish band covering slightly more than its median third, and sometimes united along the posterodorsal carina with the apical black. Tibiae and tarsi dark brown or black; in a few specimens the basal 2/3 to 3/4 of the tibiae is medium to dark brown. Claws dark brown or dark amber with black tips.

Abdomen.—The coloration is remarkably uniform and typical on all the segments except 9 (Pl. IV, Fig. 7). In 24 specimens the lateral yellow area on this segment extends from base to apex and has just apical to midlength an upward extension doubling its width for about 1/3 the length of the segment; in 9 specimens the lateral pale area is represented only by an isolated oblong spot situated in the region corresponding to the upward extension in the preceding; in 7 additional specimens this spot is present but obscured; and in 3 specimens segment 9 is entirely black.

Penis.—When this structure is fully expanded in water, the lateral fold is discernible at the base of the third segment (Pl. I, Fig. 6), and the lateral lobes of this segment extend dorsad in a smooth curve.

Abdominal appendages.—The superiors are slightly longer than the tenth abdominal segment (dorsally); occasionally the ventral laminar swelling appears to be slightly different from the type, but this is doubtless due to the orientation or to distortion in drying. The inferiors extend beyond the superiors from 0.1 to almost 0.3 mm., the distance depending partly upon the position of the appendages.

Female

The pale areas referred to as yellow in the allotype are a very pale cream color in all of this series.

Head.—Coloration similar to the male, but the pale areas are clearer and more sharply defined. The apical portion of the mandible is pale, and whether or not it is exposed to outline the

lateral edges of the labrum depends upon the position of the mandible. Median lobe of the labium cleft less than one-half its length in 7, one-half in 8, more than one-half in 4, and undeterminable in 2 specimens. The 4 pale spots across the anterior face of the frons are of approximately equal size in 4 specimens; the median spots, larger in 17 specimens. A triangular pale area with its base on the eye margin, at the level of the interocellary region, is present in all specimens. Apical ring of the first antennal segment conspicuously pale cream. The top of the head is black with metallic red reflections (7 specimens), or with both green and red reflections (anteriorly green in 13, red in 1).

Prothorax.—The color pattern in general is similar to that of the allotype (Pl. III, Figs. 4–6). In 12 specimens the black dorsum of the anterior lobe is divided by a pale transverse bar of variable width and length. When long it is semicircular and widened at each end. It is connected with the pale lateral area in 6 specimens. The pale lateral areas of the median and posterior lobes are more widely separated by black in 14 specimens than in the allotype, and in 2 specimens these lateral pale areas of the posterior lobe are narrowly joined across the posterior margin. A pair of small pale spots near the posterior margin of the median lobe are present in 2 specimens.

Pterothorax.—Pale humeral as in allotype (Pl. III, Fig. 10) in 9 specimens; the upper portion ventral to the humeral suture barely touching the lower portion (Pl. III, Fig. 11*a*) in 6, widely overlapping it (Pl. III, Fig. 11*b*) in 4, and represented by 2 isolated spots (Pl. III, Fig. 11*c*) in 2 specimens. The metepisternal pale stripe touches the lateroalar carina and is usually confluent with the pale area there in 15, and does not quite reach the carina in 7 specimens. The black stripe of the second lateral suture is considerably wider (about 1 1/2 times but not as wide as in *calverti*, Pl. V, Fig. 7) in 15 and intermediate between these and the allotype in 3 specimens. Mesostigmal lamina elevated only in the lateral half with the highest point near the anterior margin accentuated by a small pale area; posterior margin not abruptly raised from thorax; length

at mesal margin greater than at midheight, more so than shown in the drawing of the allotype (Pl. III, Fig. 9).

LEGS (Pl. IV, Fig. 8).—Coxae cream, a brown area sometimes present at the base in all 3 pairs but usually obscure or wanting. Trochanters entirely pale. Femora pale for about the basal 1/2, 2/3, and 3/5 of the first, second, and third pair, respectively; grayish bands of the pale area incomplete ventrally on first, complete and covering approximately the median third on the second and third; apical black area of about the same width on all 3 pairs, although proportionately less on each succeeding pair, and on no specimen as narrow as in the allotype (Pl. III, Fig. 8). Tibiae dark brown to black; in paler specimens the basal portion may be brown. Tarsi brown to black. Claws dark amber, black tipped.

ABDOMEN.—Allotypical in 4 specimens; coloration obscure laterally on segments 3–4 in 9, 3–5 in 7 specimens; segments 3–6 brown to lateral margin in 1 specimen.

WINGS (♂ ♀).—The following data is based upon 86 ♂ front and hind wings (1 incomplete) and 42 ♀ front and hind wings (43 ♂ and 21 ♀ specimens). Pterostigma covers 1 cell in front wing, ♂ 12, ♀ 7, hind wing, ♂ 8, ♀ 8; less than 1 cell in front wing, ♂ 74, ♀ 35, hind wing, ♂ 77, ♀ 34. Postnodals front wing, ♂ 8–12, ♀ 9–11, hind wing, ♂ 7–9, ♀ 7–10; postsubnodals front wing, ♂ 9–10, ♀ 9–11, hind wing, ♂ 7–8, ♀ 7–9 (see Table II). The superior sector (Cu_1) ends before the subnodal transversal in hind wing, ♂ 1; at the subnodal transversal in front wing, ♂ 32, ♀ 18, hind wing, ♂ 10, ♀ 4; slightly beyond but fused with the transversal vein in front wing, ♂ 43, ♀ 19, hind wing, ♂ 48, ♀ 19; and definitely crosses this vein in front wing, ♂ 11, ♀ 5, in hind wing, ♂ 26, ♀ 19. In 3 ♂ 1 ♀ specimens the sector crosses the transversal vein in all 4 wings. The median sector (M_3) arises less than one-half cell before the subnodus in front wing, ♂ 34, ♀ 20, hind wing, ♂ 22, ♀ 17; one-half cell in front wing, ♂ 50, ♀ 21, hind wing, ♂ 49, ♀ 24; more than one-half cell in front wing, ♂ 2, ♀ 1, hind wing, ♂ 14, ♀ 1. Subnodal sector (Rs) arises at subnodus in all except in 1 ♀ in which it is slightly beyond in both front and

hind wings. Nodal sector (M_2) arises in front wing nearest to fourth postsubnodal in ♂ 2; at 4 1/2, ♂ 3, ♀ 1; at or nearest to fifth, ♂ 80, ♀ 39; almost to sixth, ♀ 2; abnormal in ♂ 1: hind wing at or near fourth in ♂ 85, ♀ 41; 4 3/4, ♀ 1. Postnodal sector (M_{1a}) arises in front wing at eighth postnodal in ♂ 15, ♀ 7; at ninth, ♂ 66, ♀ 27, at tenth, ♂ 5, ♀ 8: in hind wing at seventh, ♂ 10, ♀ 8; at eighth, ♂ 73, ♀ 28; at ninth, ♀ 3; just proximal to pterostigma, ♂ 2, ♀ 2; at first subpterostigmal, ♀ 1. Median sector (M_3) ends distal to level of pterostigma in all ♂ wings and in all ♀ wings except 1 front and 2 hind wings in which it terminates on a level with the distal end. Lower sector of arculus (M_4) ends in front wing at level of distal end of pterostigma in ♂ 1; at level of proximal end, ♂ 28, ♀ 10; 1/2 cell beyond proximal end, ♂ 12, ♀ 10; 1/4 cell before pterostigma, ♂ 1; 1/2 cell before, ♂ 29, ♀ 11; 1 cell before, ♂ 11, ♀ 7; 1 1/2 cells before, ♂ 4, ♀ 4: hind wing, at level of proximal end of pterostigma in ♂ 17, ♀ 3; 1/2 cell beyond, ♂ 15, ♀ 4; 1/2 cell before, ♂ 41, ♀ 28; 1 cell before, ♂ 9, ♀ 4; 1 1/2 cells before, ♂ 2, ♀ 2; 2 cells before, ♂ 1, ♀ 1. The first antenodal costal space distinctly longest, second and third subequal, together slightly longer than the first in all. Second antenodal cross vein proximal to arculus by approximately 1/2 length of arculus, front wing, ♂ 16, ♀ 31, hind wing, ♂ 3, ♀ 11; by length of arculus, front wing ♂ 67, ♀ 11, hind wing, ♂ 60, ♀ 26; by more than length of arculus, front wing, ♂ 3, hind wing, ♂ 22, ♀ 5. Cubito-anal cross vein distal to first antenodal, front wing, 1/5 of second antenodal costal space, ♂ 2, ♀ 1, 1/4 ♂ 23, ♀ 7, 1/3 ♂ 28, ♀ 11, 2/5 ♂ 32, ♀ 23, 3/5 ♂1; hind wing, 1/6 ♂ 3, 1/5 ♂ 12, ♀ 6, 1/4 ♂ 28, ♀ 13, 1/3 ♂ 33, ♀ 14, 2/5 ♂ 8, ♀ 9, and absent in ♂ 1. Width of hind wings about 1/7 of the length; less than 1/7 in ♂ 26, ♀ 17, 1/7 in 2 ♂, 2 ♀, and slightly more than 1/7 in 15 ♂ 2 ♀ specimens.

A comparison of postnodals and postsubnodals as shown in Table II indicates that the extremes of variation are less in the postsubnodal series except in the front wings of the females.

The only venational characters which show a reliable degree of constancy are the following: (1) subnodal sector arises at

TABLE II

POSTNODAL AND POSTSUBNODAL CROSS VEINS, THE LATTER INDICATED IN BOLD-FACE TYPE

Number of Cross Veins	♂		♀		Number the Same in Each Set of Wings				Number the Same in Both Series			
					♂		♀		♂		♀	
	f.w.	h.w.	f.w.	h.w.	f.w.	h.w.	f.w.	h.w.	f.w.	h.w.	f.w.	h.w.
7		2 14		2 6		 5		1 2		2		2
8	1	63* 71**		23 33**		25 33*		9 15		51*		22
9	10** 38*	20*	4 14**	15** 3	4* 14	6	1 5*	5 1	10*		4	1
10	57 48**		22** 25	2	23 19		8 10	1	33		13	
11	16		16 3		3		6 1				3	
12	2											

* One wing represented.

** Where the holotype ♂ and allotype ♀ wings would occur if data for them were included.

subnodus; (2) nodal sector arises in front wing at or nearest fifth, in hind wing at the fourth postnodal; (3) median sector arises proximal to subnodus and ends distal to level of the pterostigma; (4) the first antenodal space is about twice as long as the second and also longer than the third. These are all in accordance with Mr. Williamson's definition of the genus (1915: 619). However, the use of the termination of the superior sector in relation to the subnodal transversal as a character to subdivide the genus into two groups is not adequately upheld. According to the data for *tenuis* only 86.6 per cent of the front wings and 64.5 per cent of the hind wings, or only 75.6 per cent of the total number of wings would place it in the proper group.

Measurements (in mm.): pterostigma, hind wing, ♂ 0.5–0.8, average, 0.693, ♀ 0.65–0.8, average, 0.703; length of hind wing, ♂ 15.6–18.0, average, 16.84, ♀ 17.2–18.5, average, 17.84; width of hind wing, ♂ 2.2–2.6, average, 2.38, ♀ 2.4–2.6, average, 2.48; length of abdomen to apex of segment 10, ♂ 29.9–33.6, average, 31.66, ♀ 26.3–29.4, average, 27.36; length of abdomen + appendages, ♂ 30.5–33.9, average, 32.26; superior appendages, ♂ 0.4–0.5, average, 0.406, ♀ 0.2–0.3, average, 0.24; inferior appendages, ♂ 0.6–0.8, average 0.69. The superior appendages were measured from the base (dorsally) to the tip; the inferiors from a point at about the middle of the base (laterally) to the tip. All the above measurements were made with a microscopical vernier micrometer kindly loaned for the purpose by Dr. T. H. Hubbell.

The locality records indicate that *P. tenuis* has a rather wide distribution around the Amazon River basin, but according to field notes of Mr. J. H. Williamson it was found only on small muddy creeks in dark woods. Specimens were generally seen hovering just above the water in dark places. Mating pairs were taken at Porto Velho on February 13, 17, and 27.

After the data for the *Protoneura tenuis* in the Williamson collection were summarized we learned of additional specimens in institutions which had given financial aid to the expedition made by Mr. J. H. Williamson and Captain J. W. Strohm in

or why the enemies should be forced to go hungry by this rather one-sided arrangement, was not further investigated.

I am indebted to Sir E. B. Poulton for references in his works to some of these records, of which a very early one is a note by Samuel Felton, F.R.S. (9), who in 1764 described a grasshopper from Jamaica with the thorax like a leaf that is raised perpendicularly from the body.

Erasmus Darwin in 1791 had drawn attention to examples of protective coloration as I have already mentioned, and wrote (6) "there is apparent design in the colours of animals, whilst those of vegetables seem consequent to the other properties of the materials which possess them." The allusion is to the well-known *Rubia* or Madder which, if eaten by pigs, turns their bones red and seems to have deleterious effects upon the animal. Hence, he concludes that "the colouring matter of vegetables like those used for tanning, varnishing, medicine. do not seem essential to the life of the plant but seem given it as a defence against the depredations of insects or other animals to whom these materials are nauseous or deleterious." Note that here is the germ of an idea which could bear full fruit only later, after the doctrine of natural selection had been expounded by his grandson. For it is obviously meant that a herbivorous animal, having eaten madder, would recognize it again and leave it alone: the existence of this protection is, however, ascribed to the care of a benevolent Creator for this particular plant. There is no suggestion that the plant is in any way especially conspicuous so that it can be readily recognized.

The great traveller Burchell noted the peculiarities by which living things escaped detection and wrote (10, p. 96) that "it is the harmony with which they have been adapted by the Creator to each other, and to the situations in which they are found, which delights the observer." He was particularly interested in a small xerophilous plant and an insect, which on the dry plains of South Africa so closely resembled small stones that "By their form and color, this insect may pass unnoticed by those birds, which otherwise would soon extirpate a species so little able to elude its pursuers, and this juicy little Mesembryanthemum may generally escape the notice of cattle and wild animals."

In 1815 the renowned entomologists Kirby and Spence (11) expounded their strictly orthodox views of the coloration of insects. They descanted eloquently upon the perfection of the resemblance of insects to parts of plants, using for this the term "Mimicry" which

1922. Through the courtesy of Mr. Nathan Banks of the Museum of Comparative Zoology, Dr. Hugo Kahl of the Carnegie Museum, and Dr. W. J. Gerhard of the Field Museum of Natural History, these specimens were received for determination. They are from the following localities in Brazil: Porto Velho, Amazonas, February 17 (2 ♂ 2 ♀ M.C.Z.; 3 ♂ 2 ♀ C.M.; 2 ♂ 2 ♀ F.M.N.H.), February 27 (1 ♂ F.M.N.H.); Villa Murtinho, Matto Grosso, April 6 (1 ♂ M.C.Z.). The color pattern, venation, and measurements of these specimens are within the range of variation recorded above. The British Museum also has a specimen (♂) from Pará, the coloration of which differs slightly from that of the holotype.

Protoneura calverti is closely related to *tenuis*. A study of the type ♂, allotype ♀, and 6 ♂ 3 ♀ paratypes in the Williamson collection shows that the 2 species are remarkably similar in size and coloration. In *calverti* the average length of the pterostigma is less (♂ 0.615 mm., ♀ 0.7 mm.), length of the hind wing is greater (♂ 17.55 mm., ♀ 18.1 mm.), width of hind wing is less (♂ 2.19 mm., ♀ 2.38 mm.), length of abdomen is greater (♂ to segment 10, 32.65 mm., ♀ 27.7 mm.), the superior appendages are longer (♂ 0.485 mm., ♀ 0.3 mm.), and the inferior appendages are about the same (♂ 0.7 mm.). With the exception of the length of the hind wing the average measurements for *calverti* are within the extremes for *tenuis*.

The thoracic coloration of *calverti* in both sexes shows less extensive pale areas. In the male the mesepisternal scarlet (or orange) area of the palest specimens is about the same as in the darkest specimens of *tenuis* (Pl. IV, Fig. 5, and Pl. V, Fig. 1) but without any upward extension on the humeral suture. These dorsal stripes in the darkest specimens extend less than half the distance to the antealar carina (Pl. V, Fig. 2). In all the specimens studied, the metepisternal pale stripe (first lateral) does not touch the metinfraepisternum below or the lateroalar carina above, and the black area of the metepimeron below is continuous ventrally with the stripe from the opposite side (Pl. V, Fig. 1). In the female the metepisternal pale stripe does not reach the antealar carina above, is much nar-

rower at the lower end, and is not wider than the black stripe of the second lateral suture ventral to it (compare Pl. III, Fig. 10, and Pl. V, Fig. 7). The dark areas on the ventral surface are more sharply defined and extensive.

The femora of the legs in *calverti* (Pl. V, Figs. 3 and 6) have slightly more extensive dark areas than in *tenuis*. The males have the first leg almost entirely black anterodorsally and posterodorsally, the second anterodorsally only, and the third black anterodorsally only in the median third of the basal pale area. In both males and females, the apical black area occupies 1/2 (or more), 2/5, and 1/3 of the first, second, and third legs, respectively. The tibiae and tarsi are the same as for *tenuis*.

In structural characters *calverti* may be distinguished from *tenuis* by the shape of the male appendages and genitalia (Pl. I) and the mesostigmal lamina of the female which has the posterior margin distinctly raised above the level of the thorax, especially in the lateral 3/4, giving it the appearance of an elevated ridge.

PLATE I

Protoneura tenuis Selys, holotype ♂, Pará, Brazil, 1850, Dale collection.

FIGS. 1–3. Abdominal appendages in dorsal, lateral, and ventral views, respectively; Fig. 1*a*, a superointernal view of the left superior appendage.

FIGS. 4–5. Penis (dry condition) in ventral and lateral views.

Protoneura tenuis Selys, ♂, Belem, Pará, Brazil, August 8, 1922, J. H. Williamson and J. W. Strohm.

FIG. 6. Penis (fully expanded in water) in lateral view.

Protoneura calverti Williamson, holotype ♂, Tumatumari, British Guiana, February 8, 1912, E. B. Williamson.

FIGS. 7–9. Abdominal appendages in dorsal, lateral, and ventral views, respectively; Fig. 7*a*, a superointernal view of the right superior appendage.

FIGS. 10–11. Penis (fully expanded in water) in ventral and lateral views.

All drawings of structural features were made with the aid of a camera lucida.

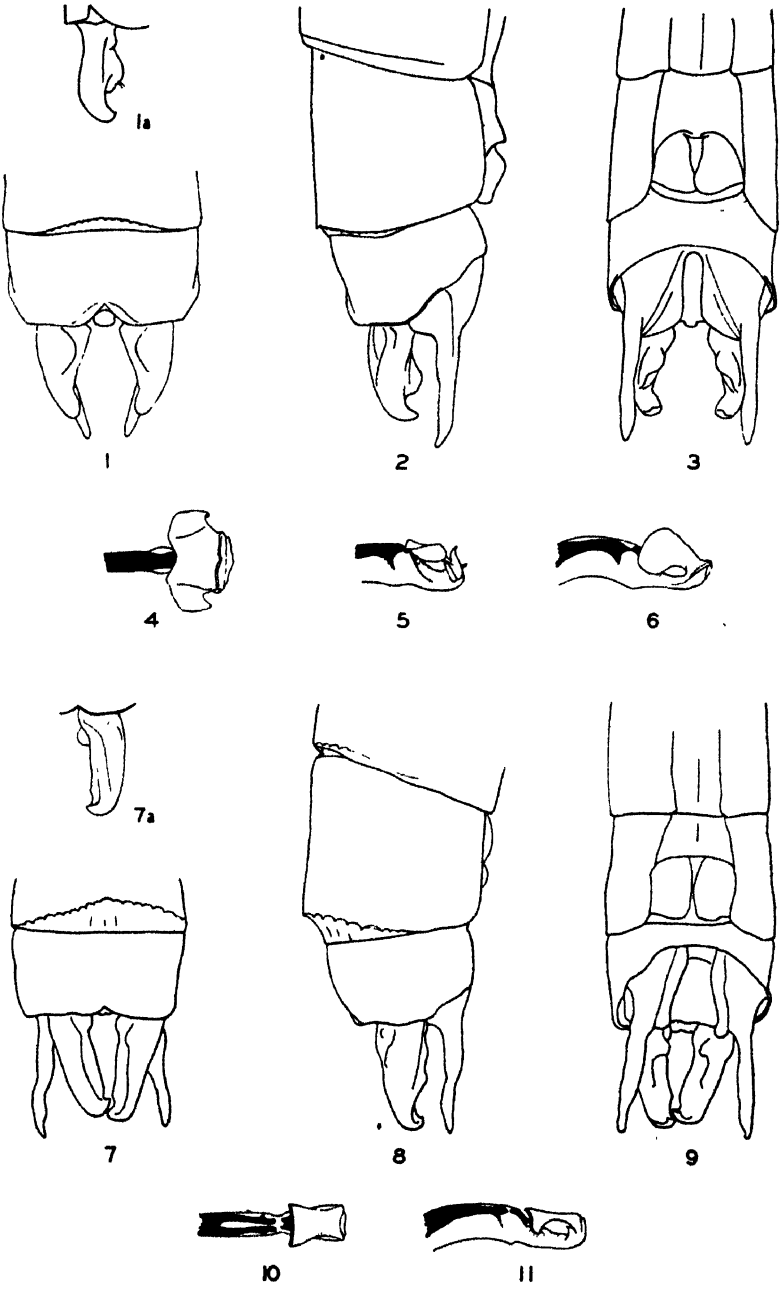
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PLATE II

Protoneura tenuis Selys, holotype ♂, Pará, Brazil, Dale collection.

FIG. 1. Color pattern of the head, front view.

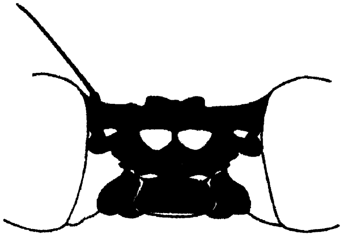
FIG. 2. Median lobe of the labium.

FIGS. 3–5. Prothorax in dorsal, anterodorsal (to show shape of hind lobe), and lateral view, respectively. The stippled area indicates the orange and the remainder, the black part of the pattern.

FIG. 6. Color pattern (diagrammatic) of the first leg showing ventral, anterodorsal, and posterodorsal surfaces. The other legs are missing in the holotype.

FIG. 7. Color pattern (diagrammatic) of the pterothorax.

FIG. 8. Color pattern of the abdomen in dorsolateral view.



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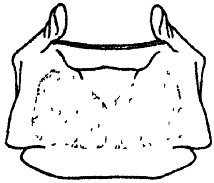

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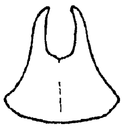

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PLATE III

Protoneura tenuis Selys, allotype ♀, Pará, Brazil, 1850, Dale collection.

FIGS. 1–3. Terminal segments of the abdomen in dorsal, ventral, and lateral views, respectively.

FIGS. 4–6. Prothorax. The stippled areas indicate black, the white areas, yellow.

FIG. 7. Head pattern, front view.

FIG. 8. Color pattern (diagrammatic) of the legs.

FIG. 9. Mesostigmal lamina.

FIG. 10. Color pattern (diagrammatic) of the pterothorax.

FIG. 12. Color pattern of the abdomen in dorsolateral view.

Protoneura tenuis Selys, Williamson series.

FIG. 11. Upper portion of the humeral pale stripe; *a, b, c,* indicate variations found in the series of 21 ♀.

PROTONEURA TENUIS SELYS

PLATE III

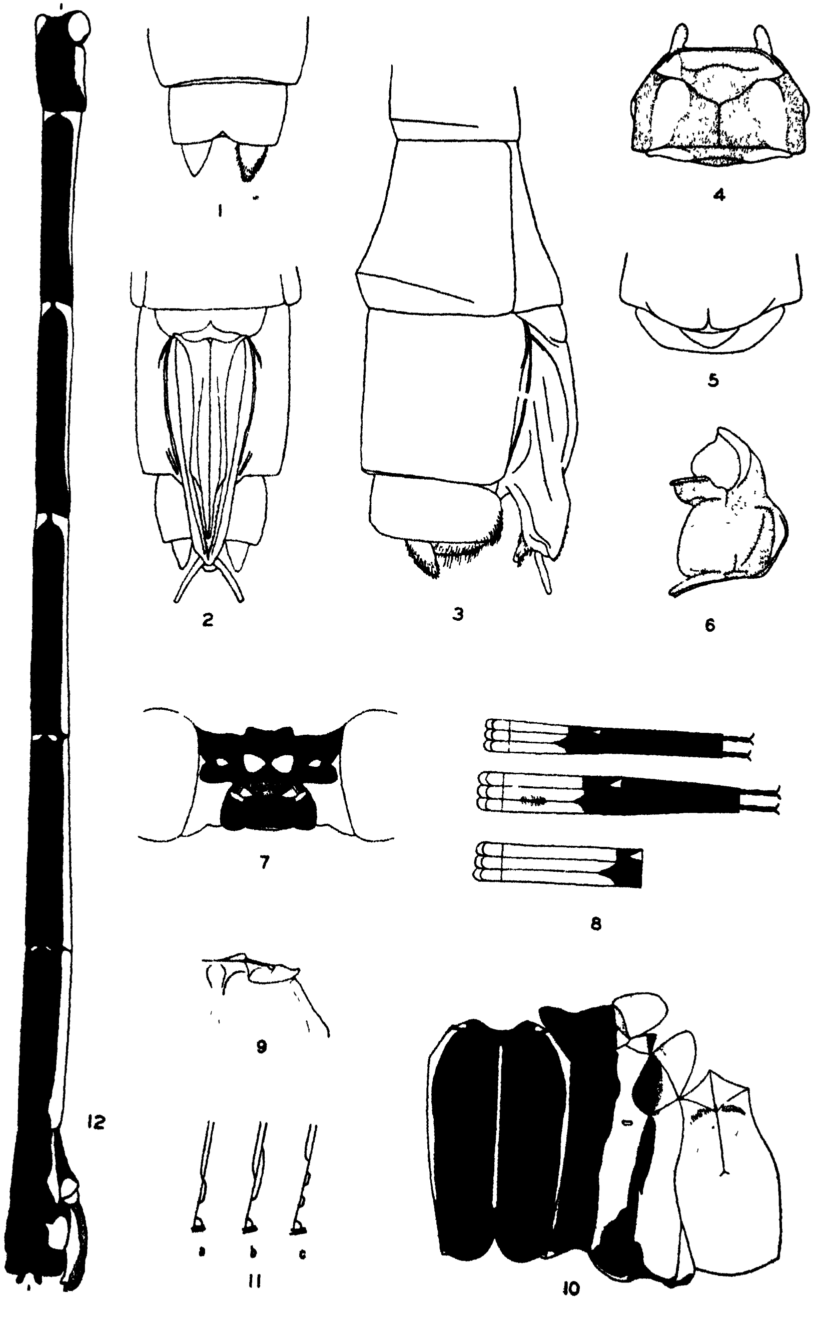

PLATE IV

Protoneura tenuis Selys.

FIGS. 1–5. Color-pattern variations in the pterothorax of the ♂. Fig. 1, ♂, Porto Velho, Amazonas, Brazil, February 17, 1922; Fig. 2, ♂, same locality, February 22, 1922; Fig. 3, ♂, Río Beni, Cashuela Esperanza, Bolivia, April 11, 1922; Fig. 4, ♂, Porto Velho, Amazonas, February 21, 1922; Fig. 5, ♂, Villa Murtinho, Matto Grosso, April 4, 1922.

Fig. 6. Color pattern (diagrammatic) of the legs of the ♂ showing only a part of the black tibiae.

FIG. 7. Variations in the color pattern of the ninth abdominal segment.

FIG. 8. Color pattern (diagrammatic) of the legs of the ♀.

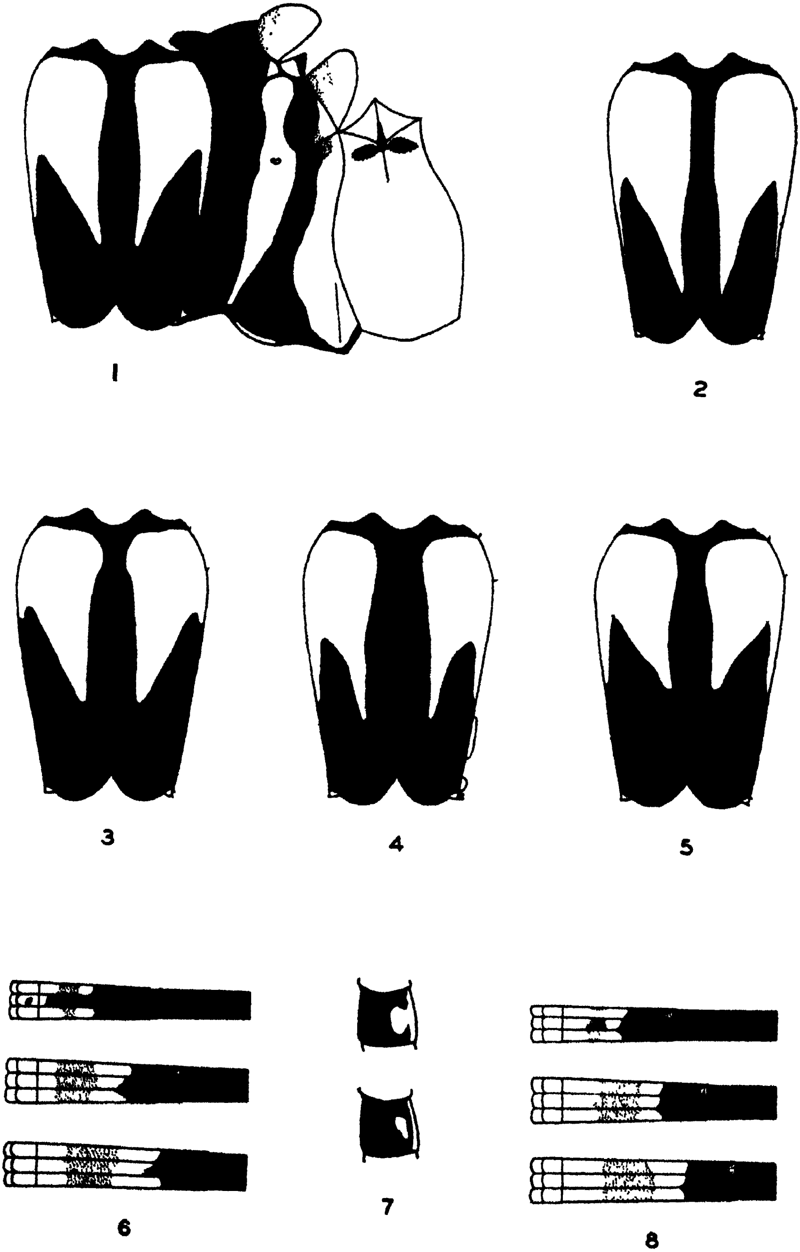
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PLATE V

Protoneura calverti Williamson.

FIG. 1. Color pattern (diagrammatic) of the pterothorax of the holotype ♂, Tumatumari, British Guiana, February 8, 1912.

FIG. 2. Color pattern of the mesepisternum of the darkest paratype ♂, Potaro Landing, British Guiana, February 10, 1912.

FIG. 3. Color pattern (diagrammatic) of the legs, holotype ♂.

FIG. 4. Variations in the pattern of the ninth abdominal segment in the ♂ paratype series.

FIG. 5. Color pattern of the head (front view), allotype ♀, Tumatumari, British Guiana, February 8, 1912.

FIG. 6. Color pattern (diagrammatic) of the legs, allotype ♀.

FIG. 7. Color pattern (diagrammatic) of the pterothorax of the allotype ♀.

is nowadays not used by scientific writers in England in that sense. Kirby and Spence wrote that Providence had not only wrought likenesses to plants, but had even contrived that insects should be regarded "as symbolical of beings out of and above nature. The butterfly . . . . gives us some idea of the blessed inhabitants of happier worlds, of angels . . . . etc. Again, other insects seem emblematical of a different class of unearthly beings . . . we can hardly help regarding them as aptly symbolizing evil demons, the enemies of man . . . , or of impure spirits for their vices and crimes driven from the region of light into darkness or punishment." Here we see an example of the pre-Darwinian habit of finding "analogies." Evil insects were analogous to evil spirits. Such views, to our minds quaint in the extreme, could only lead to the recording of curiosities without any intelligent appreciation of the place of insects in the whole scheme of things. All that was noted was that, *to man*, a species was beautiful and pleasing, or ugly and therefore objectionable, and the older writings are full of remarks of this kind.

Another point must be noticed. In a world filled with voracious predators every species must be protected. "Unless a watchful Providence had supplied them with some mode of resistance or escape this innumerable race must soon be extirpated." Thus, not only are many different examples given of such resemblances as have already been quoted, but attention is drawn to quite the opposite aspect, conspicuousness instead of concealment. A sort of half-way-house was provided by the case of a grasshopper at the Cape, "the elytra of which were of a rose or pink colour which, shrouding its vesiculose abdomen, gave it much the appearance of a fine flower." No flower, however, such as it was supposed to resemble was specified ; but because it was brightly coloured it was supposed to gain protection by looking like the only brightly coloured object that could be thought of, namely, "a fine flower."

Certain very brilliant butterflies such as the blue Morphos of South America were supposed to "dazzle" the enemy, by which one presumes it is meant that their brilliance reflects such bright light that the enemy cannot see properly to catch them !

Among means of defence were noted threatening attitudes or movements, possession of spines or stings, and emission of unpleasing vapours or fluids. Thus the *Malachius* beetles "endeavour to alarm their enemies and show their rage by puffing out and inflating four vesicles from the sides of the body, which are of a bright red, soft,

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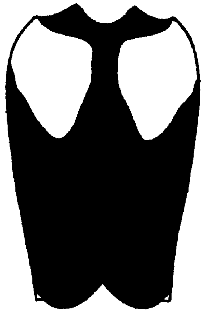

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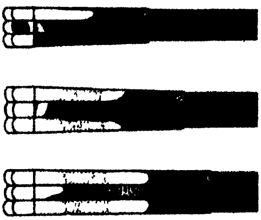

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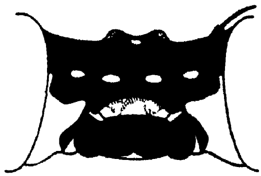

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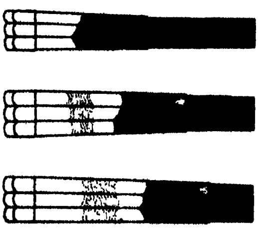

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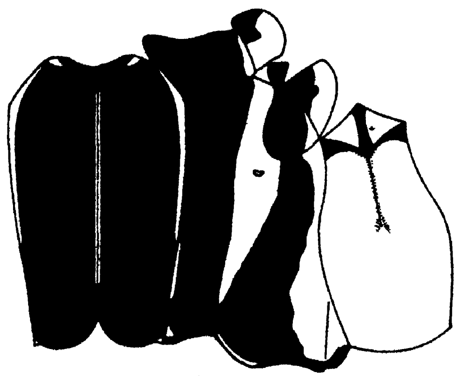

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[*Extracted from the* PROCEEDINGS *of* THE LINNEAN SOCIETY OF LONDON, Session 148, 1935–36, Pt. 2, 27 *March* 1936.]

The Butterflies of Abyssinia.

By Prof. G. D. HALE CARPENTER, M.B.E.

'ABYSSINIA', for the purposes of these notes, means not the area within the political boundary, but the area bounded by the contour of 1500 metres within that boundary.

This area contains about 400 species of butterflies, with a large number of named forms. The affinities are mainly *East* African, but in a surprisingly large number of cases they are *Western*. The typical West African fauna is that of the forest region, and butterflies support Wayland's theory that during the Pleistocene pluvial periods the western forests may have extended up the rivers at least as far as what is now known as South Sudan. But while a number of characteristically western species or forms have reached this area, most have not penetrated further. There are, however, in Abyssinia, 74 species or forms whose recorded distribution is typically western, or which find their nearest representatives in West Africa. Some of these, which frequent bush rather than forest, and others which occur in the interior of Northern Nigeria and the Cameroons and then again in Uganda, south

Sudan, and Abyssinia, suggest that there was formerly a belt of thicker bush stretching across from west to east through the Bahr-el-Ghazal.

Abyssinia is the only African part of the Ethiopian zoogeographical region into which species have penetrated from the Palaearctic zone. There are 6 of these, but they have not (with one peculiar exception) got out of Abyssinia again.

The common ‘Small Copper’ occurs as a local race, but other local races exist on the East African highlands, while a second species of the genus is found in South Africa : these facts suggest that the genus is not an invader but a relict of former days. Three links with Arabia suggest a possible way of entry for Palaearctic species into Abyssinia.

The presence of invaders in Abyssinia but nowhere else in Africa, and the absence from Abyssinia of species widespread in Africa and even abundant on the mountains of southern Sudan, suggest that the establishment of a surrounding arid belt, after the pluvial period, imprisoned the invaders and prevented others from entering from East Africa.

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ON SOME EUROPEAN YELLOW FORMS OF *PIERIS NAPI* (L.) (LEP., RHOPALOCERA): A REVIEW OF THE LITERATURE.

BY G. D. HALE CARPENTER, D.M., AND B. M. HOBBY, D.PHIL.

The Hope Department of Entomology, Oxford University Museum.

(1) THE following contribution to a study of *Pieris napi* arose from an article (Shepherd, 1936) drawing attention to an error in nomenclature of some yellow specimens in the Hope Department of Entomology, Oxford University Museum. It became necessary to ascertain the correct designation of this form. Furthermore, in order to establish this point some white forms had to be considered as well as yellow. Thus we were forced to examine the whole literature in so far as it seemed to have any bearing at all on the problem. The chief points resulting from this review are expressed in a summary.

(2) Barrett (1881) mentions a yellow female *Pieris napi* from the Norfolk fens the colour of which is described as almost exactly agreeing with that of *Gonepteryx rhamni* (L.) This is the earliest note on the occurrence of yellow *napi* in the British Isles that we have discovered.

(3) The original description by Schöyen (1885, p. 140) of ab. *sulphurea* runs as follows: "*Pieris napi* L. gen. II *napææ* Esp. ab. *sulphurea*. Blandt de af Prof. Esmark's Samling i Universitets-musæet indlemmede Exemplarer findes en ♂ af Höstgenera-tionen af *Pieris napi*, desværre uden nogen nærmere angivet Lokalitet, men antagelig fra Kristiania Omegn, der udmærker sig ved sin svovlgule Farve saavel paa Over- som Undersiden af begge Vingepar. Forövrigt er saavel Farvetegningen som Störrelse. Vingesnit etc. normale." The *résumé* in French (*op. cit.*, p. 214) says: "L'auteur norvégien mentionne, de la génération d'automne de *Pieris napi*, un male entièrement jaune soufre, offrant une intéressante analogie avec la variété *novangliae* de *P. rapae*." [The author states that in Prof. Esmark's collection of "inland" examples in the University Museum there is a male of the autumn generation of *Pieris napi*. The exact locality is not given, but presumably the specimen came from the neighbourhood of Christiania. Both pairs of wings are of a sulphur-yellow colour both on the upper and undersides. The markings, size and shape of the wings are normal.]

(4) Barrett (1893, p. 25) alludes to the specimen mentioned in 1881, adding: "In this specimen the 'veins' are pale grey. Yellowish females with darker nervures have been taken in Aberdeen, Inverness, Ross, and Fife; and at Sligo Mr. Russ has found them of a very pale yellow ground colour, but with the nervures above all broadly suffused with grey to their tips, a variation more closely approximating to the form called *Bryoniæ*—which occurs in Alpine districts—than any other yet seen by myself in these islands. A yellow variety, with dark nervures and clouded with grey, was taken in the south of England by Mr. S. J. Capper many years ago."

(5) Kane (1893, pp. 118–119) writes: "Two specimens of a very beautiful yellow aberration have been taken, similar to the one described by Mr. Barrett, from the Norfolk fens. One of these was taken by me in August at Redhills, Co. Cavan, and presented to Mr. Jenner Weir. The other was given me by Miss Reynell, of Killynon, Westmeath. Both were female. Ground colour a saffron-yellow, with bases and all the nervures to the fringes broadly suffused with grey. Apical blotch and spots large, dark, but shaded off at the edges. Under side of the hind wing and apex of fore wing a deep yellow-ochre, approaching orange; nervures shaded with greenish grey. A male of this aberration has been taken in Scandinavia, on the authority of M. Schöyen . . ." The name ab. *flava* is proposed. For figure see Kane (1901, pl. iv, fig. 6). [The new aberration is described from female specimens, whereas Schöyen's type is a male. Kane is incorrect in referring his new aberration to Schöyen's *sulphurea* since the yellow ochre on the underside of the fore wing only affects the apex, while Schöyen describes the wings of his specimen as entirely sulphur yellow. It is difficult to understand Kane's action in naming as ab. *flava* a form which he says is the same as one recorded by Schöyen, which had already received the name *sulphurea*. Possibly Kane saw only the French *résumé* of Schöyen's paper in Swedish, which does not use the name *sulphurea*.]

(6) Reuter (1893, p. 10) records a female specimen of the second generation from Russian Lapland in the University of Finland under the name "ab. *sulphureotincta* n. ab.", which is distinguished by "alis superne sordide flavescentibus, posticis inferne laetius sulphureis". From this it seems that the yellow on the upperside is dirty yellow and on the under-surface of the hind wing it is brighter yellow. The under-surface of the forewing is not mentioned. In the same paper ab. *sulphurea* Schöyen is referred to as a brighter sulphur-yellow form of var. *bryoniae* Ochs, standing in the same relation to it as ab. *sulphureotincta* does to the chief form ("hufvudformen").

(7) Mosley (1896) figures (pl. ii, fig. 10) a new variety, *aurea*, in black and white, but instead of giving a description merely states (p. 6): "From one in Mr. Capper's collection. Mr. Barrett has very kindly sent me a very good drawing of a similar one, executed by his daughter: others exist in various collections." [This entirely inadequate indication of a new form does not enable us to determine its status. Possibly Barrett's note concerning a specimen caught by Capper (*vide supra*, sect. 4) refers to *aurea*.]

(8) Tutt (1896, p. 236) says: "In both broods of this species in Ireland pale yellow forms are frequent, and these are known as ab. *sulphurae*. These lead almost insensibly to the greyish-ochreous Alpine form of the female, which is so largely suffused with dusky scales as to present quite a melanic facies, and is known as ab. *bryoniae*. In it, the nervures are grey and very broad." Tutt's ab. *sulphurea* is further mentioned (p. 237) as having "All the wings of a clear sulphur-yellow, the females yellow (*flavescens*). The under side pale, as in *napaeae*. and the veins indistinct". [This cannot be the true *sulphurea*, on account of the pale underside. The name *flavescens* appears to be used here for the first time; therefore this account constitutes a description of a new female form. There is no reference to this point in Talbot's catalogue (1932, p. 248), in which the name *flavescens* is attributed to Wagner (1903) and Frohawk (1928).]

(9) Staudinger and Rebel (1901, p. 11) sink ab. *sulphureotincta* Reuter as transitional to *sulphurea* Schöyen.

(10) Wagner (1903) describes (p. 176, and pl. i, fig. 1) as *flavescens*, females of the second generation from limestone hills near Mödling and Baden, using Staudinger's MS. name. [The name *flavescens* Wagner is invalid; see sect. 8 above.] The wings are shaped as in var. *napaeae* Esp.: above they are of a more or less vivid yellow with strongly developed black markings, and dark powdering at the base of the fore wing. The hind wings have only the base slightly suffused with dark scales; the ends of the veins are marked with black wedges, and there is a black spot at the anterior margin.

The underside of the hind wings and of the apex of the fore wings is mostly of a beautiful canary-yellow, with the veins faintly or not at all dusted with dark; the black spots, which are well shown above, are rudimentary beneath.

Other yellow females occurring in the same localities are described as follows:

> (*a*) Of the first generation, showing above the vivid yellow of *flavescens*, but in the elongated shape of the wings, and their markings, agreeing with *napi*. The veins of the hind wings above and below are darkened throughout, and the underside

of the hind wings is not the bright canary-yellow of *flavescens*, but more greenish-yellow (pl. i, fig. 2).

(*c*) Examples (pl. i, fig. 4) more or less transitional to typical *bryoniae* of the higher mountains and of Arctic Europe. The fore wings are much darkened. The underside lacks the broad dark vein characteristic of *bryoniae* and especially of the hind wing.

These two forms are not named by Wagner, as he considers they may be identical with Kane's *flava*, or perhaps with *intermedia* of Krulikowsky (1890, p. 211, pl. viii, fig. a). [The original description of *intermedia* is here reproduced from the Russian publication : " (gen. 1). P. Napi, var. Bryoniae subsimilis. Alis albis ad basin griseo pulveratis. Anticae supra apice grisescente. ♂ macula disci parva, grisea, aut nulla. ♀ nervis maculisque griseis, dilatatis. Subtus alae nervis griseo-dilatatis ; posticae flavo-sulfureae, saepe viridescentes ".] Wagner's series consists of specimens of which (*a*) are near to *flava* Kane and (*c*) to *intermedia* Krul. Krulikowsky's clear *figure* of the latter shows it to be a white form with only a faintly yellow tint on the underside of the hind wings and of the apices of the fore wings ; thus the two ends of the series are distinct. Nevertheless the *description* of the underside of the hind wings as sulphur yellow, often greenish, does bring *intermedia* nearer to *flava* than is apparent from the illustration.

[In a footnote (p. 177) Wagner suggests the possibility that the older name *sabellicae* Stephens (1827) = *nigrovenosa* Selys (1844) might have to take precedence over *intermedia* Krulikowsky (1890). Concerning the identity of *sabellicae* and *nigrovenosa*, Selys (1857, p. 5, and 1887, p. 40), Röber (1907, p. 49), Verity (1908, p. 143), Stichel (1908) and Kautz (1927, p. 48) are agreed.

Verity separates *intermedia* from *sabellicae*, but we do not agree with his conception of *intermedia*. He seems to apply Krulikowsky's name *intermedia* to examples mentioned as distinguished "par la teinte du fond des ailes sur les deux surfaces, qui est d'un beau jaune soufre ". This is erroneous, because according to Krulikowsky's description of *intermedia* only the under-surface of the hind wing is "flavo-sulphureae ". Verity accepts Wagner's figure (pl. i, fig. 4) as typical of *intermedia*, whereas Wagner himself is in doubt whether the specimen he figures could correctly be termed *intermedia*. Tutt (1896, p. 237) notices Selys' view that *sabellicae* and *nigrovenosa* are identical, yet continues to use the later name, keeping it separate from *intermedia*. We conclude that *sabellicae* Stephens (1827) should take precedence over *nigrovenosa* and *intermedia*.]

There remains Wagner's form (*b*) of the second generation for which he proposes the name *meta*. This form is described as

differing from his *flavescens* by the white ground-colour, by the apical black markings on the upper-surface of the fore wing and the two black spots on its under-surface being more strongly developed, and by the ends of the veins of the hind wing being of a deeper black above. [Wagner's figure (pl. i, fig. 3) does not give the impression of "die gelbe Färbung gänzlich mangelt und deren Grundfarbe weiss bleibt". Schima (1910, p. 282) points out that Wagner himself had told him that on the upperside the figure is too yellow.]

The males of these three forms (*a*, *b*, *c*) do not differ from each other, and only slightly from ordinary *napi*.

Wagner further states that none of these three forms is identical with *sulphurea* or *sulphureotincta* and figures the type of the latter (pl. i, fig. 7), nor does he agree with the statement of Staudinger and Rebel (1901) that the two latter forms are the same. He gives Strand's reasons for considering that *sulphurea* is an aberration of *napi*; this is of importance because other authors had included it under *bryoniae*. *Sulphurea* represents a yellow male and, therefore, cannot be identical with Wagner's forms (*a*, *b*, *c*), the males of which do not differ in colour from ordinary *napi*. *Sulphureotincta* differs from Wagner's forms (*a*, *b*, *c*) chiefly by the paler yellow colour and the much fainter black markings of the upper-side; this can be seen from Wagner's plate i.

(11) Wagner (1904) figures a striking aberration from near Turin, March 10th, 1903, which is of a pale citron yellow above and has the underside of the hind wings bright yellow strongly marked with ochre yellow. The specimen was sent to Strand, who reported that it was distinctly not *sulphurea*, because in the latter the underside of the hind wing does not differ from that of the normal Norwegian form.

(12) South (1906, p. 39) says: "Specimens with a distinct creamy tint on the wings are sometimes met with, but such varieties, as well as yellow ones (var. *flava*, Kane), are probably more often obtained in Ireland and Scotland than in England."

(13) Röber (1907, p. 48) describes females of the spring brood from the neighbourhood of Vienna transitional to *bryoniae* with "the vein-streaks of the forewing somewhat broadened, but not very prominent, the ground-colour of the upperside slightly yellow" under the form-name *interjecta*. Ab. *radiata* Röber of the same brood and from the same locality has "still less yellow than *interjecta*, but the forewing above much more extendedly and diffusely darkened, the discal spots indistinct, being united with the vein-streaks, the hindwing on the contrary with sharply-marked black costal spot and well defined streaks along the veins, these streaks running like rays from the cell to the distal margin;

the dark markings on the forewing below feebly developed ". He includes among the summer form *napaeae* Esp. ab. *sulphurea* Schöyen (pl. xxi, row c), defined as females with normal pattern, but sulphur-yellow upperside. [Röber is incorrect, as Schöyen's type was a male. The coloration of the figure is a dirty brownish-yellow, not what we call sulphur-yellow.] Ab. *meta* Röber refers to females " with a slightly yellow tint on the upperside, the black markings on the distal portion of the forewing, less so on the hind wing, being very prominent though diffuse ". [See discussion of the name *meta* under section 15 below.]

(14) Verity (1908, p. 149) refers to European aberrations of *napi*, and under " gen. vern. ♀ ab. *sulphureotincta*, Reuter ", with *interjecta* Röber as a synonym, says that the type from Russian Lapland belongs to the spring generation and is distinguished above " par le fond des ailes jaune et voilé d'écailles obscures et par les dessins très pâles et indistincts ; le revers des postérieures est d'un beau jaune vif ". [We do not agree that *sulphureotincta* is the same as *interjecta*. The latter is described as having the vein-streaks somewhat broadened—a feature which is not apparent from Wagner's figure (1903, pl. i, fig. 7) of the type of *sulphureo-tincta*.] The " gen. vern. ♀ ab. *flava*, Kane ", is said to be a " forme à fond des ailes jaune de la ♀ du *napi* printanier ". [The coloured figure (pl. xxxii, fig. 45) is misleading because it differs considerably from Kane's figure of *flava*, being cream-coloured while Kane's is intensely yellow.] Verity considers that the name ab. *sulphurea* should be extended to females with yellow ground-colour and normal black pattern. The " gen. aest. ♀ ab. *flavescens*, Stdgr., *in litt.* : Wagner " is poorly figured by Verity (pl. xxxii, figs. 46 and 47), who alludes to it as a widely distributed rare aberration, but common enough near Vienna.

(15) Stichel (1908) accepts Selys' (1857 and 1887) view that the name *nigrovenosa* is synonymous with *sabellicae* and transitional to *bryoniae*. He points out that according to Röber's diagnosis *meta*, of a " slightly yellow tint ", must be regarded as a strongly coloured form of *sabellicae*, although according to Röber's figure his *meta* is a pale form of *bryoniae*. [It should be pointed out that *sabellicae* is of the spring generation, whereas *meta* is specified by Röber as of the summer generation ; both names are thus valid. Stichel's allusion to *intermedia* as like *sabellicae* is sound.] Krulikowsky's illustration of *intermedia* (pl. viii, fig. a) is said to agree fairly well with Wagner's figure (pl. i, fig. 8) of an Austrian specimen erroneously named ab. *bryoniae*. [*Intermedia* is a white form and only yellow on the under-surface of the hind wing, whereas *bryoniae* is a yellow form, and not like Wagner's fig. 8.] Röber's *nana* is considered by Stichel to be the male of Reuter's *sulphureotincta* ; but

and of an irregular shape. When the cause of the alarm is removed they are retracted."

It seems doubtful to us nowadays whether a hungry enemy would be deterred by the "rage" of a beetle less than half an inch long! The observation here is correct, the real meaning missed, for it depends upon the bright red vesicles the significance of which it was for Darwinians to explain, and not upon the imaginary "rage" of the insect.

The emission of odours was even conceived by the naturalist A. H. Swinton (12) to be merely an expression of fear, and the point as we see it now was entirely missed. Thus, he writes "Muscular contractions on touch or sight, accompanied by emission of liquids or odours from secretory glands likewise indicate fear . . ." and "the emission of odours that accompanies the paroxysm of fear may also express anger."

The point was missed that insects that emit such odours are commonly conspicuous by colour and habit. The connection between conspicuousness and distastefulness passed unnoticed until the principles of natural selection taught by Darwin made it possible to understand why conspicuousness and distastefulness *should* be connected.

Thus Gosse in 1859 (13) mentions some conspicuous beetles which "delight to bask on the prairie flowers." One of them, a *Cetonia* "whose brown elytra are elegantly marked with white spots, gives out a very fragrant smell." We now know that Cetoniid beetles, generally speaking, are relatively distasteful to at any rate some insectivores; they give out a foully smelling fluid when disturbed and the "fragrant" smell passes very easily into an unpleasant one, as in Cerambycid beetles. Gosse also notes (*loc. cit.* p. 210), "A pretty but offensive bug," black and scarlet, found crawling on plants.

Another highly interesting phenomenon was accounted for from the same standpoint of perplexing or alarming enemies. Some butterflies with tails to the hind wings often have eye-like spots at the bases of the tails, and move the the latter in such a way that they suggest a head at the opposite end to the real head. This was supposed to perplex or alarm the assailant. But there is actual evidence (14) to suggest that these apparent eyes invite attack at an unimportant part of the insect so that if seized or pecked there, it can escape with the loss of a small part of the wing and without damage to a vital part. Examples of his views on insect coloration and behaviour are so interestingly set forth by Gosse (*loc. cit.*) that they must be mentioned.

it would appear from Reuter's original description (1893) that *sulphureotincta* is a new aberration of "var. gen. II *napaeae* Esp.", whereas Röber describes *nana* as an aberration of the spring generation. Stichel would sink *interjecta* Röber because it grades into *flava* Kane. In our opinion *interjecta* being described as "slightly yellow" and *flava* being "saffron yellow" they are distinct; moreover, *interjecta* is described as of the spring generation, whereas "August", the only reference to time given by Kane, suggests that *flava* is of the summer generation.

Stichel's tables (pp. 71–74) have every appearance of being useful, but an examination shows them to be not free from error. The only means of checking tables of this nature is by personal examination of types and of the distribution of the so-called forms, races and subspecies.

(16) Krulikowsky (1908, p. 209) proposes a new name, *regressa*, to replace his *intermedia*; the reason for this proposal is not clear.

(17) Schima (1910, p. 283) points out that he had seen the type of *meta* Röber and that the figure (Röber, 1907) is too yellow, so that it rather resembles *flavescens*. He is of the opinion that, according to Röber's diagnosis, *meta* Röber is the same as *meta* Wagner, and that Röber's "form. nov." in Seitz is merely an oversight. [It must be remembered that Wagner himself said that the figure of his *meta* was too yellow, and in the description emphasized the entire absence of yellow from the upperside. The only difference which we can distinguish between *meta* Wagner and *meta* Röber is that the latter is described as having "a slightly yellow tint on the upperside", but this difference does not seem to us great enough to distinguish one from the other. The name *meta* Röber, therefore, should be abandoned. Schima, considering *flavescens*, states that this form has most of the black markings much darker, and most of the ground-colour more uniformly yellow than is indicated in Wagner's figure. Moreover, *flavescens* is by no means restricted to lower Austria, but is widely spread although discontinuously, specimens having been obtained at the foot of Monte Rosa. At higher altitudes *flavescens* flies with *bryoniae*.

A new female aberration, *flavometa*, of var. *napaeae* Esp. is described (p. 284); it is like *meta* in markings, and like *flavescens* in its intensive yellow ground-colour. Specimens of this new form are mentioned from Mödling, "Moistrana, Carn.", and from "Feuchtenbachgraben, Austr. inf.". Certain females of the summer generation from near Mödling are stated to have normal markings, the ground-colour being pronounced sulphur to ochre or saffron. These forms are analogous to ab. *interjecta* of the spring generation; they differ from Röber's figure of *sulphurea* by

having the ends of the veins of the upperside of the hind wing sharply marked. Schima points out that Schöyen erected *sulphurea* on a male from Norway, and protests against using the name for a supposedly analogous female form from Austria, but he accepts it, since authorities such as Röber (1907) and Verity (1908) have done so. Ab. *lutescens* Schima is a female form of the spring generation from Mödling, like *radiata* Röber, but the ground-colour of all the wings above is not white or whitish, but yellow.

(18) Schmidt (1913) records a captured female in Donegal of a wonderful yellow colour, from which were obtained five male and nine female typically white specimens and four males and three females of the yellow form like the parent, but with a few quite small differences. The yellow is described as " ein ganz intensives Gelb, dunklere Nuance in der Farbe wie Pieris napi sulphurea Schöyen, alle anderen Zeichnungen waren mit sehr wenig Verschiebungen die gleichen wie bei der Stammform von P. napi, so dass nur die ganz ausserordentlich gelbe Bestäubung, wie schon erwähnt, in Betracht kommen kann ". [The phrase, quite intensive yellow, together with the locality, strongly suggests that this may be the form subsequently named *citronea* by Frohawk (1928) from Head's MS.] Yellow bred females were crossed with normal white males bred from Irish pupae, and yielded about 75% typical white forms and always only a small proportion of yellow. These yellow forms Schmidt named *hibernica* ; he mated one of the males with a wild female, obtaining from twenty-two pupae five white specimens (all females) and seventeen yellow ones (eleven males, six females). These hybrid yellow forms he named *schmidtii*, and described them as having " die gelbe Bestäubung wenn auch nur wenig so doch etwas zurückgegangen und durch eine Einlage von Gelbgrau ersetzt worden ".

(19) Stauder (1914) describes under a quinquenomial designation a new aberration *palunae*, a female of the summer generation from the Austrian coast, which is analogous to *flavescens* Wagner in ground-colour, but has the black markings more strongly developed.

(20) Verity (1916, p. 77). The writings of Verity are extraordinarily confused. We are here only concerned with what he appears to conclude regarding yellow forms. *Flava* Kane and *flavescens* Wagner are considered to be yellow forms of the first and second generations of his *napi* s. sp. *vulgaris*, the type of which came from Florence. The name *septentrionalis* is proposed for a " race " of his s. sp. *napi vulgaris* ; the type is from Westcliff-on-Sea, but specimens differ little from others from the northern parts of central Europe. [This form is here mentioned because the name is used by Kautz (1927) in regard to yellow forms.]

(21) Verity (1922, pp. 134–6) discusses specimens from Sweden in which the extent of the black markings in the second generation is similar to that of the first generation of some other races; to these specimens he assigns the name *linnaei*, adding, "this, no doubt, is the race which produces the yellow form *sulphurea*, Schöyen, described from the extremely rare male, but more frequent in the female sex". Verity elevates *flavescens* Wagner to the status of a race of which he considers *interjecta* to be the first generation. He includes in this race the form *meta* Wagner with ground-colour white, which he says is figured by Röber (1907); and apparently, also *sulphurea*, stating that the "males and white females differ in no way from *subnapaeae*, Vrty.". [It is to be noted that in 1916 *flavescens* is said to be a yellow form of *vulgaris*; in the present paper Verity makes the comparison with his new *subnapaeae*. Moreover, Verity having assigned *sulphurea* Schöyen to his race *linnaei* (p. 134) appears on p. 136 to consider that it belongs to the race *flavescens*.]

(22) Frohawk (1924) figures (pl. v, fig. 21) a "♂ Var. Donegal, July. 1911, F. W. F. coll.", and states: "In Ireland examples of both broods are sometimes met with having a yellow ground colouring, ..." He does not apply a name to these forms.

(23) Kautz (1927) gives a comprehensive account of *Pieris napi*. He points out (p. 51) that the name *flava* was applied by Kane to yellow forms of both *brassicae* and *napi*, and is of the opinion that the name should be abandoned; there is, however, no ruling in the International Rules of Nomenclature against the custom of using identical names for parallel forms among different species. The name *röberi* is proposed for the female aberration *meta* Röber which, as we have pointed out above, is a homonym of *meta* Wagner. [In view of our considered opinion (sect. 17) that *meta* Röber = *meta* Wagner, the new name *röberi* for the former seems unnecessary, so that the following table of female forms (after Kautz) requires adjustment.]

Forms of the Spring Generation.

White.		Yellow.
septentrionalis Verity.	.	*interjecta* Röber.
radiata Röber.	.	*lutescens* Schima.

Forms of the Summer Generation.

White.		Yellow.
subnapaeae Verity.	.	*sulphurea* Schöyen.
röberi Kautz.	.	*flavescens* Wagner.
meta Wagner.	.	*flavometa* Schima.

[Our comment upon Stichel's table also applies to this.]

(24) Frohawk (1928) refers to "the beautiful yellow form, ab. *sulphurea*, also known as var. *flava*, Kane". [But see comments on Section 5.] He describes the breeding of a yellow strain by Mr. H. W. Head in the following terms: "In 1909 Mr. Head received from Donegal one wild specimen of the pale yellow form, and all he has bred during the last eighteen years, numbering over 50,000 specimens, have been descendants from that particular individual, but each two or three years he has introduced wild Irish types to cross with them. The percentage of yellow forms varies greatly; some years they occur in fair numbers, while in others very few appear. More than once a pairing between ♂ and ♀ ab. *sulphurea* has resulted in only normal white individuals. Although the depth of the yellow colouring varies greatly, all individuals showing it have been classed as ab. *sulphurea* Schoyen (= var. *flava* Kane). The two extremes of yellow in different examples are so distinct in colour, however, that Mr. Head calls the deep yellow form ab. *citronea*, to distinguish it from the paler yellow ones. . . . The different yellow forms of *P. napi* may be named as follows:

1. Ab. *flavescens* n. ab.—pale lemon or primrose yellow.
2. Ab. *sulphurea* Schoyen—bright sulphur yellow.
3. Ab. *citronea* (Head MS.) n. ab.—rich citron yellow.
4. Ab. *radiata* (Head MS.) n. ab.—nervures black.
5. Ab. *olivacea* (Head MS.) n. ab.—markings olive brown."

[The name *flavescens* is a homonym of *flavescens* Wagner (1903), a form with the upperside of all wings more or less of a vivid yellow with strongly developed black markings—hind wings and apex of fore wings underneath mostly canary-yellow. The description by Frohawk of a "pale lemon or primrose yellow" obviously applies to a different form, but his name cannot be used for it. Both Wagner's and Frohawk's names are homonyms of *flavescens* Tutt (1896).

Ab. *radiata* is a yellow form of undescribed shade with "nervures black". This incomplete description, so far as it goes, tallies with that of *radiata* Röber (1907). Should the two forms be identical the name should be assigned to Röber; if the forms are different the name *radiata* Frohawk is preoccupied.]

(25) Vogt (1929) describes in detail specimens of the second generation from near Osa in the Polish Carpathians and concludes that they do not deserve a special name, but may be regarded as extreme "*meta* Wagner (nec *meta* Röber)" differing by the following points: (1) Ground-colour of a curious greenish-yellow; (2) the greater part of the fore wing above is suffused with dark scales; (3) the hind wing is also suffused with dark scales and has a dark spot as in *posteromaculata* Reverdin. It is a personal matter whether the more intensively yellow specimens should be considered as var. *flavometa* Schima.

(26) Bollow (1932) criticizes Verity's races severely. Ab. *sulphurea* is ignored: "Colour variations are: ab. *flava* Kane (=*flavometa* Schima) of the first generation has a yellowish upperside: in the Austrian Alps. A similar colouration in the second generation from Mödling near Vienna with a brighter yellow and with an increase and considerable extension of the black markings is called *flavescens* Wagner. . . . ♀-ab. *lutescens* Schima is characterized by its ochre or saffron-yellow ground-colour; the arrangement of markings is similar to *radiata* Röb.: Mödling near Vienna."

[The sinking of *flavometa*, which is said to have the markings of *meta* but an intensive yellow ground-colour, in favour of *flava* does not seem quite justifiable. The question is not one merely of colour, but also of pattern. In *meta* there are wedge-shaped black areas marking the distal ends of the veins of the hind wing, which are not shown in Kane's figure of *flava*, and on the fore wing *meta* has much more black between the veins than *flava*.

Bollow's description of *flavescens* as differing from *flava* by being brighter yellow and having an increase and a considerable extension of the black markings is not borne out by comparison of the original figures.]

(27) Donovan (1934) asks, "What is the Irish ab. *sulphurea* Schöyen of *Pieris napi* L.?" and answers, "It is an artificial product, either by breeding experiments, of which I know nothing or by staining by picric acid. . . . In the ab. *flava* Kane, a quite distinct product and a genuine native of Ireland, the yellow is of a dull orange-ochre, an intensification of the much paler ab. *meta* Röber. The yellow colouration of the upper wings is limited to the females. and the discal area on the under surface of the anterior wings remains markedly white. . . . In *P. napi* of the palaearctic region, the females only assume a xanthic change on the upper surface of the wings, yellowish in abs. *meta* and *flava* and a dirty smoky-yellow in ab. *bryoniae*; but we find in ab. *sulphurea* the males as well tinged with a vivid sulphur or canary yellow". Donovan states that by treatment with picric acid the "desired yellow" was obtained and this could be discharged by suitable reagents.

(28) Frohawk (1934, p. 312) says, "In Ireland, chiefly in Donegal, yellow forms, known as ab. *flava*, Kane, occasionally occur. . . . In July, 1926, Mr. H. W. Head succeeded in breeding probably a unique specimen . . . having the left side female, ab. *citronea* n. ab., and the right side typical white male. . . . Among over 50,000 specimens of *P. napi* bred by Mr. Head during the past twenty-five years (the ancestor being a pale yellow form from Donegal), the large number of yellow types obtained show every

graduation of colouring from the palest lemon-yellow to deep, rich citrine-yellow and dusky ochreous-yellow. The markings are equally variable in depth of colouring and development."

[In this work a yellow male form is figured under the name "ab. *sulphurea*". This figure is nearer in colour to specimens of Head's strain in the Hope Department than is the figure given by Frohawk [1924]. It is to be noted that the name *sulphurea* is not the one used in the text. The name *citronea* here used by Frohawk was first published in 1928 and should not be cited as new in 1934.]

(29) Head (1935) denies an accusation of artificially colouring *Pieris napi* with picric acid, and states that all specimens that he has sent out are genuine bred yellow varieties, descendants of a specimen of a pale yellow colour, both upper and underside, received on May 18th, 1909, from Ramelton, Co. Donegal. "This yellow var. is certainly not the ab. *sulphurea* Schoyen of *Pieris napi*, and I gave the name of *citronea* to it . . ."

[Specimens in the Hope Department of Entomology, Oxford University Museum, bearing the label "Origin Donegal, bred . . . H. W. Head", cannot be described as sulphur-yellow, but would seem to fit Head's MS. name *citronea* first published by Frohawk, 1928, rather than the name *sulphurea* Schöyen.]

(30) Bouck (1935) wrote a letter to Head in which he says that he has bred *P. napi* "from ova, larvae and pupae from you for years now, and each year I get one or two yellow ones out of hundreds of ova . . ."

(31) Main (1935, *a* and *b*) bred two bright yellow imagines from ova laid by a typical female from South Devon. These were "of a paler colour and not such a rich yellow as the ab. *citronea*". Donovan discovered that in specimens treated with picric acid "the sulphur hue was discharged by the use of a solution of boric acid and sodium benzoate, but the normal yellow colour on the underside of the wings was not affected by this treatment". Main confirmed this, and also "obtained some specimens of ab. *citronea* and tested them with the solution of boric acid and sodium benzoate and found that they were unaffected by it, so could not have been stained by picric acid. I also tested one of the S. Devon specimens with the same result".

(32) Valle (1935, p. 42) writes, "ab. *flava* Kane, ei = *sulphurea* Schöy." [But see comments on Section 5.]

(33) Shepherd (1936) disagrees with Donovan that the Irish aberration of *P. napi* which is sulphur-yellow above and below and is referred by him to ab. *sulphurea* is an artefact, and states that "There is abundant evidence that numbers of the yellow aberration have been bred, . . . It can be described as having the normal pattern, but the ground-colour of the upper- and

undersides of both pairs of wings citron yellow. the discal area on the underside of the fore wings slightly paler than the upperside, hairs on thorax pale yellow, body blackish, wing markings in the summer or autumn broods pure black, in the spring brood sometimes grey, nervures of underside of hind wings olive, fainter in the summer brood ". Ova obtained in June, 1934, from Head's Donegal stock gave typical white *napi*. These were paired and yielded in the following April, typical white *napi*, three yellow males and two yellow females. Shepherd notes that Schöyen's male type is " distinguished by the sulphur-yellow colouring on the upper- and undersides of both pairs of wings. Apart from this the colouring, wing-marking, etc., are normal. Further reference to the specimen states: The male under consideration is a *pure* sulphur yellow ". [The phrase " further reference " is obscure.] Shepherd points out that yellow specimens in the Hope collection, being of the Donegal strain, come under ab. *citronea* Head. All " are labelled ab. *flava* Kane. with references to the *Entomologist* (**26** : 119, **33** : 328, **34** : 456). This is clearly an error in labelling, as the abs. *citronea* and *flava* are separate aberrations markedly different one from the other. . . . One must assume that the ab. *citronea* labelled as ab. *flava* are the ab. *sulphurea* of Lt.-Col. Donovan, unless there are in the Hope Department at Oxford some true ab. *sulphurea* Schöyen not listed above ".

[There are some errors in Shepherd's remarks. The first specimen bears data showing that it was bred in June, not in July, and only the first six from the Horne collection are labelled *flava* Kane, suggesting that the name was put on at a date before the last three, bought from Newman in 1924, were added to the collection. The Hope collection was arranged according to South (1906), who gave the name *flava* Kane for yellow specimens; Head's MS. name *citronea* was not published by Frohawk until 1928, and was not available at the time the collection was arranged. The last reference given to *flava* should read pl. iv, fig. 6, and not 456. It is correct that there are in Oxford no " true *sulphurea* ", but only specimens of Head's Donegal strain.]

(34) Donovan (1936, p. 4) says: " The so-called 'Donegal' bright yellow-, sulphur- or citron-coloured specimens, corresponding, as I take it, to the ab. sulphurea, Schöyen, are not found in a state of nature but produced by artificial contrivances ; by selective inbreeding, for instance. . . . Kane considered his saffron-coloured, female, *flava*, to be the same as Schöyen's *sulphurea*. . . . But the colours do not tally, Schöyen's is 'jaune soufre' and Kane's saffron-yellow ; these tints are exactly hit off by using solutions of picric acid and saffron or turmeric respectively ".

(35) Donovan (1934 and 1936) has shown that the yellow

colour produced in the wings of *Pieris napi* by treatment with picric acid is discharged by a solution of boric acid and sodium benzoate. Main has shown, however, that these reagents do not destroy the yellow colour of ab. *citronea*.

The following tests suggested by Dr. S. G. P. Plant also confirm that the yellow colour of *citronea* is not due to picric acid :

(*a*) Soak a wing of typical white *napi* in a 0·75% solution of picric acid in water for six hours, wash well to free it from excess acid and then dry. The colour produced is almost indistinguishable from that of true ab. *citronea*.

(*b*) Boil the yellow wing with a little water (about 0·3 c.c.) for a few seconds. Cool the resulting yellow solution, add three drops of dilute ammonia solution and a pinch of solid sodium hydrosulphite ($Na_2S_2O_4$). An immediate red colour develops, but fades after about 15 seconds.

(*c*) If the second of the above experiments is repeated with a wing of true ab. *citronea* no red colour is produced.

Summary.

[*The numbers do not refer to the sections above*]

1. The first note on the occurrence of yellow *napi* in the British Isles was by Barrett (1881).

2. Schöyen (1885) described *sulphurea* from a Norwegian male.

3. Kane (1893) described an Irish female as *flava*, wrongly considering it to be the female of *sulphurea*.

4. Reuter (1893) described a female from Russian Lapland as *sulphureotincta*.

5. Mosley's indication (1896) of *aurea* is inadequate.

6. Tutt's description (1896) of *sulphurea* from Irish yellow males does not agree with that of Schöyen. The new name *flavescens* is applied to the females.

7. Staudinger and Rebel (1901) sink *sulphureotincta* as transitional to *sulphurea*.

8. Wagner (1903) describes *flavescens* and *meta* from Austrian females, the latter not being yellow ; but see item No. 6 above.

9. We conclude that *sabellicae* Stephens (1827) should take preference over *nigrovenosa* Selys (1857) and *intermedia* Krulikowsky (1890) ; these are white-forms.

10. Röber (1907) describes forms *interjecta* and *radiata* from slightly yellow Austrian females ; his figure of *sulphurea* Schöyen is incorrect. The name *meta* is proposed as though new.

11. We do not agree with Verity (1908) that *sulphureotincta* is the same as *interjecta*.

12. Stichel's view (1908) that *interjecta* is the same as *flava* and that *meta* Röber is a strongly coloured form of *sabellicae* is incorrect.

13. We fail to understand Krulikowsky's reason (1908) for proposing the name *regressa* to replace *intermedia*.

14. We agree with Schima (1910) that *meta* Röber (1907) is the same as *meta* Wagner (1903).

15. Schima (1910) describes *flavometa* and *lutescens* from Austrian females.

16. Schmidt (1913) describes *hibernica* and *schmidtii* which he obtained by breeding from an Irish strain. The former is intensive yellow, the latter yellowish-grey.

17. Stauder (1914) describes *patunae* from a yellow Austrian female.

18. Verity (1916) assigns *flava* to the first generation of his *napi vulgaris* and the corresponding form *flavescens* Wagner to the second generation.

19. Verity (1922) assigns *sulphurea* to his *linnaei*, and elevates *flavescens* Wagner. of which *interjecta* is the first generation, to the status of a race, which also includes *meta* Wagner. He also apparently includes *sulphurea* in *flavescens*, forgetting that he had previously assigned it to *linnaei*.

20. We consider that the name *roberi* Kautz (1927) is unnecessary.

21. Frohawk (1928) repeats the error of uniting *sulphurea* with *flava*; his *flavescens* is a homonym of the names used by Tutt (1896) and Wagner (1903); his name *radiata* is inadmissible.

22. We do not agree with Bollow (1932) that *flavometa* is the same as *flava*.

23. Donovan (1934) states that " the Irish ab. *sulphurea* Schöyen . . . is an artificial product ".

24. Frohawk (1934) uses *citronea* as a new name as though he had not already published it in 1928.

25. Head (1935) insists that all his *citronea*, which he distinguishes from *sulphurea*, are genuine natural products.

26. Bouck (1935) states that he has regularly bred one or two yellow specimens each year from material supplied by Head.

27. Main (1935) shows that in artificially stained specimens the colour can be discharged by appropriate reagents, but this is not the case with *citronea*.

28. Shepherd (1936) does not agree with Donovan that the Irish " ab. *sulphurea* " is an artifact. for it has often been bred. He suggests, quite rightly that specimens in the Oxford Museum labelled *flava* and called *sulphurea* by Donovan are *citronea*.

29. Donovan (1936) reiterates his belief that Donegal specimens are " artificial contrivances ", and points out that the tints of *flava* and *sulphurea* can be matched respectively by suitable staining.

30. A specific and delicate chemical test is described which proves that the yellow colour of *citronea* is not due to picric acid.

31. The following table was compiled with the kind help of Mr. N. D. Riley, to whom the MS. was submitted. We have not seen the types, and therefore do not feel justified in a more decisive opinion on the status of the names :

A. Markings normal : ground-colour primrose, lemon or sulphur ; *i. e.* with definite greenish shade.
(1) *sulphurea* Schöyen, 1885.
(2) *flavescens* Tutt, 1896.
(3) *hibernica* Schmidt, 1913.
(4) *schmidtii* Schmidt, 1913.
(5) *flavescens* Frohawk, 1928.
(6) *citronea* Frohawk, 1928.

B. Markings accentuated : ground-colour less greenish, *i. e.* ochreous :
(1) *flava* Kane, 1893.
(2) *flavescens* Tutt, 1896.
(3) *flavescens* Wagner, 1903.
(4) *interjecta* Röber, 1907.
(5) *radiata* Röber, 1907.
(6) *flavometa* Schima, 1910.
(7) *lutescens* Schima, 1910.
(8) *patunae* Stauder, 1914.
(9) *radiata* Frohawk, 1928.
(10) *olivacea* Frohawk, 1928.

Note.—*Sulphureotincta* Reuter, 1896, cannot be assigned to either of these groups ; in colour it would belong to B, but the markings are reduced.

32. The lemon-coloured specimens in the Oxford Museum referred to in Sections 1 and 33 above are probably *hibernica* Schmidt, with *schmidtii* Schmidt and *citronea* Frohawk as synonyms.

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* We have not been able to read this paper.

The book constantly alludes to the wisdom, foresight, etc., of the Creator, in devising protection for insects, and the current idea of analogy is exemplified by remarks (p. 56) on brown Satyrine butterflies which "fly along close to the ground, beneath the shrubs, and in the shelter of the fence, as if shade were more congenial to their feelings than sunshine. Perhaps, as there is a correspondence and a harmony in all the divine works, there may be a reference to these retiring habits in the dull tint common to the tribe, and the want of those glowing colours so general among butterflies."

The anthropocentric conception of rage by which Kirby and Spence explained the antics of a small beetle is so strong in Gosse's mind that the following is worth quoting as an example. He mentions (p. 74.) changes of colour in some lizards which "I had been inclined to consider . . . . a gross exaggeration, if not a mere fable." A small lizard which, after being chased was captured by boys, was said by them to be "the little green tree-lizard, which had become black from being on the dark logs, and . . . . would turn green again if placed on a leaf. This I could not at all believe . . . ." However, the experiment was made: the lizard did turn brilliant green but Gosse could only say, "I suppose the black colour was not caused by the animal's being on the black logs, but was the effect of anger on being chased."

Regarding odours, Gosse (p. 207) noted that it was supposed that they were intended as a means of defence, but "I have reason to think they may be connected with a reproductive economy . . . Two large plant bugs (*Pentatoma*) on being disturbed, diffused suddenly their rank odour, in a degree far more pungent than I had ever before smelt . . . ."

Thus, on the old views, inconspicuous insects were endowed with invisibility by a merciful providence; conspicuous insects frightened, perplexed, or dazzled the intending enemy.

Let us now begin the consideration of our next subject; the resemblance of one insect to another, for which the term "Mimicry" is now used in default of a better popular term. It is of course erroneous in its suggestion of *conscious* purpose, but there is no other non-technical term suitable, and it is hallowed by long usage.

Kirby and Spence come very near to the interpretation of one case of this resemblance. They pointed out that certain large flies (*Volucella*) lay their eggs in the nests of Bumble bees in which their larvae were supposed to devour the larvae of the bees. It was therefore held that the flies resemble the bees by a provision of the

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THE IDENTITY OF *ACOSMETIA MORRISII* DALE (IN MORRIS).

BY H. M. EDELSTEN, F.R.E.S., AND W. H. T. TAMS, F.R.E.S.

THIS moth, which was first described in 1837 (*Naturalist*, **2** : 88) from Charmouth specimens, was presumed to be a whitish form of *Petilampa minima* Haw. It was afterwards considered to be the same species as *Arenostola bondii* Knaggs, which had been taken at Folkestone sixteen years later. Different authors have since assigned it to both species, though Tutt, in *British Noctuae*, **4** : 99, correctly placed it. However, the discovery of three specimens in the Dale Collection in the Hope Department at Oxford, has resulted in this species being satisfactorily determined after one hundred years of uncertainty.

Through the kindness of Prof. G. D. Hale Carpenter we were enabled to make an examination of the genitalia of these specimens. The result proves that the Charmouth insect is not a form of *P. minima*, but is one and the same species as *A. bondii*.

The name *bondii* Knaggs will now become a synonym of *Arenostola morrisii* Dale (in Morris), by which name the insect should be known. A list of the more important references to this species is given below :

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A CONTRIBUTION TOWARDS A STUDY OF *CALOSOMA INQUISITOR* L. (COLEOPT., CARABIDAE).

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CONTENTS.

Historical Introduction.

The earliest reference to any species of the present genus *Calosoma* is that of Réaumer (1736), who gives an interesting description of the habits of a black worm and scarab; it is almost certain that he refers to the larva and adult of *Calosoma sycophanta* L. respectively.

Rolander (1750) gives this description: 'Carabus alatus viridi-aeneus: elytris convexe punctatis striatisque, pedibus antennisq nigris'; there is no doubt that he is considering *Calosoma inquisitor* L. Linnaeus (1758) gives his original description under *Carabus*: 'C. elytris striatis viridi-aeneis: punctis triplici ordine.' Until 1801, nearly all writers referred to this species as *Carabus inquisitor*, but Geoffroy (1762) alludes to it as 'Le bupreste quarré couleur de bronze antique,' Fourcroy (1785) as *Buprestis antiquus*, and Voet (1793) as *Buprestis sycophanta minor*.

In 1801, Weber subdivided the Linnaean genus *Carabus* into *Carabus s. str.* and *Calosoma*, the latter name being derived from the Greek words καλος, meaning beautiful, and σωμα meaning body. Four species (*Calosoma sycophanta, inquisitor, alternans, reticulatus*) were included in the genus *Calosoma*, of which *Calosoma sycophanta* was selected as the genotype by Latreille (1810).

The genus *Calosoma* Web. has subsequently been divided into numerous sub-genera, accounts of which are given in Breuning (1927), Csiki (1927) and Lapouge (1929).

Age and Fossil Record.

Burgeon (1933) states that the occurrence of two species both in Australia and in South America leads to the supposition that the genus *Calosoma* is a very ancient one. Fossils are known as early as the Oligocene and Upper Miocene (Heer, 1861).

Geographical Races.

A number of geographical races and varietal forms of *Calosoma inquisitor*, chiefly based on difference in colour, have been recognized in recent years. Their main distinguishing characteristics and geographical distribution are briefly indicated below, except in a few instances marked with an asterisk, where information on either or both these subjects is not available to the writer. With the possible exception of *Calosoma inquisitor cyanescens*, which Lapouge (1929) considers to be a distinct species, and the Caucasian races which possess only three dilated protarsal segments in the male instead of the normal four, there can be little doubt that these are all forms of *inquisitor*.

C. inquisitor inquisitor var. *viridi-marginatum* Letz.
Copper brown with bright green margins. Central Europe.
Letzner (1850), Jakobson (1906), Kuhnt (1912-13), Reitter (1908), Breuning (1927), Csiki (1927).

C. inquisitor inquisitor var. *obscurum* Letz.
Elytra entirely black with coppery or greenish margins. Central Europe.
Letzner (1850), Schilsky (1889), Jakobson (1906), Breuning (1927), Csiki (1927).

C. inquisitor inquisitor var. *coeruleum-marginatum* Letz.
Elytra black with blue margin. Central Europe.
Letzner (1850), Schilsky (1889), Jakobson (1906), Breuning (1927), Csiki (1927).

C. inquisitor inquisitor var. *coeruleum* Letz.
Blackish-blue. All Europe and as far as Siberia.
Letzner (1850), Lomnicki (1894), Reitter (1896, 1908), Jakobson (1906), Kuhnt (1912-13), Porta (1923), Breuning (1927), Csiki (1927), Luchnik (1931).

C. inquisitor inquisitor var. *varians* Letz.
Pronotum more or less green, elytra blue. Central Europe.
Letzner (1850), Jakobson (1906), Csiki (1908, 1927), Kuhnt (1912-13), Breuning (1927).

C. inquisitor inquisitor var. *nigrum* Letz.
Black. Central Europe.
Letzner (1850), Schilsky (1889), Jakobson (1906), Csiki (1908, 1927), Kuhnt (1912-13), Breuning (1927), Luchnik (1931).

* *C. inquisitor inquisitor* var. *obscura* Torre.
Black.
Torre (1877), Jakobson (1906), Breuning (1927), Csiki (1927).

* *C. inquisitor inquisitor* var. *nuda* Torre.
Coppery without blue margin.
Torre (1877), Schilsky (1889), Jakobson (1906), Breuning (1927), Csiki (1927).

* *C. inquisitor inquisitor* var. *pulchra* Torre.
Coppery with blue margin.
Torre (1877), Schilsky (1889), Jakobson (1906), Breuning (1927), Csiki (1927).

C. inquisitor inquisitor var. *violaceum* Westhoff.
Blue. Holland and all Europe as far as Siberia.
Westhoff (1882), Heyden, Reitter and Weise (1883), Everts (1898), Jakobson (1906), Reitter (1908), Csiki (1927).

**C. inquisitor inquisitor* var. *funerea* Rag.
Sicily.
Ragusa (1905), Jakobson (1906), Porta (1923), Breuning (1927).

Calosoma inquisitor cupreum Dej.

Copper-brown with greenish lustre; only three dilated protarsal segments in male. Caucasus, Polonia, Roumania, Serbia and South Russia.

Dejean (1826, 1837), Fischer (1825-28), Chaudoir (1846), Gaubil (1849), Motschulsky (1850, 1865), Marseul (1867), Gemminger and Harold (1868), Géhin (1876), Kraatz (1877), Stein and Weise (1877), Heyden, Reitter and Weise (1883, 1906), Reitter (1896), Roeschke (1896), Semenov (1898), Apfelbeck (1904), Jakobson (1906), Luchnik (1910, 1931), Zaitzev (1918), Breuning (1927), Csiki (1927), Lapouge (1929).

C. inquisitor cupreum var. *reticulatum* Stéven.

Strongly rugose. Georgia.

Fischer (1825-28), Dejean (1837), Gaubil (1849), Kraatz (1877), Gemminger and Harold (1868).

C. inquisitor cupreum var. *viridescens* Rtt.

Bronze with green only on sides. Caucasus.

Reitter (1896), Roeschke (1896), Semenov (1898), Heyden, Reitter and Weise (1906), Jakobson (1906), Luchnik (1910, 1931), Kuhnt (1912-13), Breuning (1927), Csiki (1927).

C. inquisitor clathratum Kol.

Black and blue, only three dilated protarsal segments in male. Caucasus, Georgia, South Russia, Tauria, West Persia.

Kolenati (1845), Motschulsky (1850, 1865), Marseul (1867), Géhin (1876), Kraatz (1877), Heyden, Reitter and Weise (1883, 1906), Reitter (1896), Roeschke (1896), Semenov (1898), Lapouge (1904, 1912, 1929), Jakobson (1906), Luchnik (1910, 1931), Breuning (1927), Csiki (1927).

C. inquisitor cyanescens Motsch.

Black. Only three dilated protarsal segments in male. Caucasus, Siberia, region of the R. Amur and Usuri.

Motschulsky (1850, 1859, 1865), Marseul (1867), Kraatz (1878), Heyden (1880), Csiki (1927), Lapouge (1929), Luchnik (1931).

* *C. inquisitor cyanescens* var. *denserugatum* Geh.

Géhin (1885), Jakobson (1906), Breuning (1927), Csiki (1927).

C. inquisitor punctiventre Reiche.

Coppery-green. Greece.

Reiche and Saulcy (1855), Strauch (1861), Motschulsky (1865), Marseul (1866, 1867), Gemminger and Harold (1868), Géhin (1876), Kraatz (1877), Stein and Weise (1877), Heyden, Reitter and Weise (1883, 1906), Reitter (1896), Apfelbeck (1904), Jakobson (1906), Breuning (1927), Csiki (1927), Lapouge (1929).

C. inquisitor punctiventre var. *coeruleum* Rag.

Blue. Galicia, Sicily.
Ragusa (1883, 1905), Lomnicki (1894), Jakobson (1906), Breuning (1927), Csiki (1927).

C. inquisitor jaccardi Heer.
Upper Miocene fossil.
Heer (1861), Breuning (1927), Lapouge (1929).

C. inquisitor batnense Lall.
Olive-green. Algeria, Tunisia.
Lallemant (1868), Bedel (1895), Jakobson (1906), Breuning (1927), Csiki (1927), Lapouge (1929).

C. inquisitor viridulum Kr.
Green. Asia Minor, Syria.
Kraatz (1877), Jakobson (1906), Breuning (1927), Csiki (1927), Lapouge (1929).

C. inquisitor viridulum var. *cupreofulgens* Chapm.
Blue head, blue-green prothorax, copper-bronze elytra. Syria.
Chapman (1912), Breuning (1927), Csiki (1927).

C. inquisitor comanense Lap.
Copper-brown and green. Roumania.
Lapouge (1930).

Common names, mainly German, by which *Calosoma inquisitor* has been designated, are :—
Aufpaffer, Aufspahender Schönkäfer, Aufsucher, Callisoma, Häscher, Kallosoma, Kletterlaufkafer, Raupenjagende, Raupenjager, Raupjager, Rupsenjager, Schönkäfer, Schönlaufkäfer, Schönlieb, Schönliebkäfer, Spürkäfer.

Distribution.

Burgeon (1933) records the distribution of ninety-three species of *Calosoma*, thereby demonstrating a world-wide frequency of the genus :—

	Species.
Tropical Africa	14
Tropical Africa and Madagascar	1
Africa and Asia	1
Africa and Eurasia	1
Madagascar	2
North Africa and western Asia	3
Eurasia	4
Europe	4
East Asia	6
West and central Asia	7
India	2
Australia	2
North America	22
Mexico	11
Antilles	1
South America	12

The sub-genus *Calosoma s. str.* is found universally except in South America, and the species *Calosoma inquisitor* is confined to Europe, Asia and north Africa. *Calosoma inquisitor inquisitor* is restricted to central and eastern Europe, and is, with very rare exceptions, such as the blue aberration of Jennings (1902) and ab. *coeruleum* Letz. and ab. *viridi-marginatum* Letz. taken by A. Ford in the New Forest (W. J. Fordham *in litt.*), the sole representative of the species in Great Britain, where it occurs fairly frequently although somewhat localized.

The Forest of Dean, the New Forest and Hainault Forest are three areas in which it has been observed the most abundantly. It has not been captured further north than Grange, Borrowdale, in Cumberland, where Mr. F. T. Carter took one in June, 1907, and Tilberthwaite, near Coniston, in Lancashire, where Grace (1919) found four females. It has only been recorded on one occasion in Ireland: at Powerscourt, Co. Wicklow.

The following lists show the distribution of *Calosoma inquisitor*; authors and references are bracketed after the corresponding localities.

ALGERIA. Forêt de Batna, Hénon (G. Allard in Bedel, 1895). Batna, Letourneaux, Hénon (Reiche, 1872). Berouaghia (Anecy); Djebel Aurès, Valley of Medino, at the foot of Djebel Chalia (H. de la Perraudière); Forêt de Teniet-el-Had; Col. de Tizi-Franco, between Milianah and Cherchell (Jouvenot, coll. Sedillot); (Bedel, 1895).

ASIA MINOR. (Bedel, 1895). Adana (coll. Breuning); Ali-Hotscha (Bodemeyer); Amasia (Korb); Bulghar Maaden (Bodemeyer); (Breuning, 1927).

AUSTRIA. Linz (Duftschmid, 1812). St. Leonhard, Styria (Brancsik, 1871).

BELGIUM. Groenendael; Forêt de Murdael; Waterloo; (Borre, 1881).

BRITISH ISLES. ENGLAND AND WALES. *Berkshire*:—Bagley Wood (F. W. Hope, 1820, 1821, 1822; MS. in Marsham (1802) in Hope Library); (Shipp, 1893); (F. W. Lambert, 1895, 1896, 1897; A. H. Hamm, 1918; in coll. J. Collins); (B. Tomlin, 1895; W. Holland, 1897, in Hope Coll.). First recorded by Dawson (1854). Burghfield (C. S. Bird, 1834), also recorded by Curtis (1823-40) and Stephens (1839). Windsor Forest (H. Griesbach in Curtis, 1823-40). First recorded by Samouelle (1819), also recorded by Brewster (1830). *Cambridgeshire*:—Gamlingay (Wollaston, *in litt.* G. J. Kerrich). White Wood, Tetworth (Dawson, 1854). *Carmarthen*:—Stott (1894). *Cumberland*:—Grange, Borrowdale (F. T. Carter, 1907, in coll. S. Campbell). *Devonshire*:—Ivybridge (Fowler, 1906). Tavistock (W. E. Leach in Brewster, 1830). *Essex*:—Chingford (Bowman, 1919). Epping Forest (Dollman, 1910). First recorded

Author of nature so that they might lay their eggs without interference by the bees who were supposed to be deceived by the bee-like appearance.

Here we see the facts of resemblance explained by an incorrect supposition—that the fly is an enemy of the bee which would recognize it as such and would destroy it were it not deceived by the resemblance. The more probable explanation is given by Darwinism, as we shall see; the fly escapes being eaten because of its bee-like appearance which deceives enemies.

Such deceptive resemblances are of the same type as the resemblances to vegetable products which so delighted earlier observers, but they failed to perceive the existence of these resemblances because there was no clue to their interpretation, with rare exceptions such as the case of *Volucella.*

Burchell the traveller, however, as Poulton pointed out (10, p. 117) certainly was aware that these deceptive resemblances of one insect to another had a meaning. Thus in 1828 he notes of a spider "Black . . . . runs and seems like an ant with large extended jaws." This account in a few words epitomizes the character of some of the most marvellous cases of mimicry, and is particularly interesting in its early recognition of the fact that mimicry often depends greatly upon movement or habits, and is a phenomenon of *life*, a fact often ignored by critics.

Burchell, though he had an explanation for the likeness of the desert insect or plant to stones, did not attempt to explain the resemblance of one insect to another.

Such resemblances were recorded in detail in 1838 by Lucas (15) who pointed out that in certain butterflies nature has reproduced the same design and the same colour in genera quite far from each other in kinship; and he pointed out also that beyond the analogy of colour and pattern nature has given these species the same habits and created them side by side. Such resemblances were even found between butterflies and moths, and an analogy was found between Lepidoptera and insects of other orders, *e.g.*, the wasp-like "Clearwing moths." No attempt at an explanation of these likenesses was made, however, except by theological views.

Thus Macleay (16) set forth at length in 1819, with particular reference to insects, a doctrine of analogy, in which he very correctly pointed out the important differences between structural resemblances due to real affinity, and others due to analogy; but he overemphasized the latter to such an extent that he produced an entirely

by Curtis (1823-40), Stephens (1828). Hainault Forest (Norman, 1844). (E. W. Janson, 1853, in coll. O. E. Janson). First recorded by Stephens (1839). *Gloucestershire*:—Forest of Dean (Hodgson, 1879-80, 1882). *Hampshire*:—Alton (F. J. Killington *in litt.*). Baddesley (F. J. Killington *in litt.*). Bishopstoke Woods (E. T. Hayward *in litt.*). Chandler's Ford (F. J. Killington *in litt.*). New Forest (Gulliver, 1889, in Eur. Coll. Brit. Mus.) (Chitty, 1892) (Bryant, 1890, in W. J. Fordham *in litt.*) (Donisthorpe, 1895) (A. R. Heath, 1895, in Hope Coll.) (Bouskell, 1896) (Tremayne, 1897) (Jennings, 1898) (Gillespie, 1903) (Thoules, 1903) (1904, in Eur. Coll. Brit. Mus.) (Ellis, 1905) (Walker, 1917) (South, 1918) (blue ab. Priske, 1919) (Jones, 1921) (J. J. Walker, 1923, in coll. J. Collins) (Blenkarn, 1924) (T. Stainforth, 1930, in W. J. Fordham *in litt.*) (ab. *coeruleum* and ab. *viridi-marginatum*. A. Ford in W. J. Fordham *in litt.*). Beaulieu Road (F. J. Killington *in litt.*). Linwood and Redshoot Woods, Bratley (F. H. Haines *in litt.*). Brockenhurst (blue ab., F. B. Jennings and R. W. Lloyd in Jennings, 1902) (Black, 1925). Brockenhurst (in Eur. Coll. Brit. Mus.). Nr. Hythe (Ford, 1896). Lyndhurst (E. T. Hayward *in litt.*). Matley, Longdown, Rhamnor (blue ab. P. Harwood *in litt.*). (F. C. Woodforde, 1916, in Hope Coll.). Queen's Bower (West, 1907). Ringwood (Fowler, 1891) (Haines, 1928). Wootton Heath, Wilverley (C. E. Tottenham, 1918, *in litt.*). First recorded by Dawson (1854). *Kent*:—Darenth Wood. First recorded by Curtis (1823-40), Stephens (1828). *Lancashire*:—Coniston, near Tilberthwaite (Grace, 1919). *Leicestershire*:—Near Leicester (Dawson, 1856). Budden Wood (Plant, 1857) (Holyoak, 1871). Seal Wood (Fowler, 1887). *London*:—Coombe Wood. First recorded by Curtis (1823-40), Stephens (1828). Dulwich. First recorded by Stephens (1839). Bishop's Wood, Hampstead (1863, in coll. O. E. Janson). Norwood (D. Bydder and W. Weatherhead in Samouelle, 1819). *Merionethshire*:—Near Barmouth (Jackson, 1907). *Norfolk*:—First recorded by Donovan (1794). St. Faith's Wood (J. Hooker in Curtis, 1823-40). *Shropshire*:—Smethcote (F. W. Hope. MS. in Marsham (1802) in Hope Library). *Staffordshire*:—Burnt Wood, near Market Drayton (Chappell, 1865) (F. C. Woodforde, 1918, in Hope Coll.). Near Burton-on-Trent (Harris, 1865). *Suffolk*:—Battisford (in coll. Baker, Morley, 1899). Bentley Woods (Baylis and Eaton in Morley, 1899). IRELAND. *Co. Wicklow*:—Powerscourt (Tardy in Curtis, 1823-40, Stephens, 1839) (Furlong in Hogan, 1856).

BULGARIA. Kamcik, Karlak (Reiser), Rhodope, Sliven (Haberhauer), Svistov, Varna (Apfelbeck, 1904).

CORSICA. (Deville, 1906).

CRETE. (Coll. Mus. Vindob.) (Breuning, 1927).

DENMARK. (Pontoppidan, 1763, 1765).

FINLAND. (Sahlberg, 1827).

FRANCE. *Allier*:—Bois de la Brosse, near Montluçon (des Gozis); Moulins (Olivier); (Fauvel, 1882). *Alsace*: —(Fauvel, 1882). *Aube*:—Bois de Chennegy (Le Brun); (Bedel, 1881). Pont sur Seine (Lourné); (Fauvel, 1882). *Basses Alpes*:—Les Dourbes (Bellier de La Chavignerie); (Fauvel, 1882). *Basses Pyrenees*:—Eaux-Bonnes (L. Dufour); Ossau (Pandellé); (Fauvel, 1882). Mts. of La Vallée d'Ossau; (Dufour, 1843). *Calvados*:—Falaise (Fauvel); (Bedel, 1881). Bois Férant (Fauvel, 1882). Bois de Latour; Bois de Longpré (Bedel, 1881). Moulines (Fauvel, 1882). Villers-s-mer (Bedel); (Bedel, 1881). *Cantal*:—Le Lioran (Noel); (Fauvel, 1882). *Côte d'or*:—(Rouget); (Fauvel, 1882). Rouvray (Emy); (Bedel, 1881). *Eure*:—Forêt d'Evreux (Mocquerys); (Bedel, 1881). *Gers*:—Auch (Bauduer); Puycasquier (de Larcenne); (Fauvel, 1882). *Haute Marne*:—Bois de Champigny-lès-Langres (Royer); (Bedel, 1881). *Haute Pyrenees*:—Bois de Bordères; Lannemezan; Maubourguet; Tarbes; (Fauvel, 1882). *Haute Savoie*: — Rumilly (de Manuel); (Fauvel, 1882). *Haute Vienne*:—de Condat (Samie) Limoges, bois de la Bastide (Degers); du Puy-Moulinier; (Fauvel, 1882). *Hérault*: —(Géhin); (Fauvel, 1882). *Ille et Vilaine*:—Forêt de Rennes, bois de Cicé et de Laillé (L. Bleuse); Le Four-Rouge, near Rennes (L'abbé Michelet); (Houlbert, 1903). *Isère*:—(Fauvel, 1882). *Jura*:—(Fauvel, 1882). *Loire*:—St. Etienne, Bois de Solaure (Favarcq); (Fauvel, 1882). *Loire Inférieure*: —(Pradal); Astillé (R. de la Perraudière); Mayenne (R. de la Perraudière); (Houlbert, 1903). *Maine et Loire*: — Angers (Fauvel, 1882). Champigny (Gust Abot); (Houlbert, 1903). Forêt de Fontevrault et d'Ombrée (Millet); Gennes; St. Barthélmy; Saumur; (Fauvel, 1882). Neighbourhood of Saumur (Gust Abot) (Houlbert, 1903). Thorigné; Trélazé; (Fauvel, 1882); common everywhere (Millet); (Houlbert, 1903). *Manche*:—St. Hilaire-du-Harcourt (Fauvel); (Fauvel, 1882). *Marne*:—Rilly (Bedel, 1881). Germaine (Lajoye). *Morbihan*:—Berons (Griffith); Plandren (Griffith); (Houlbert, 1903). Ste. Anne D'Auray (Elphège); (Fauvel, 1882). Vannes (Griffith); (Houlbert, 1903). *Moselle*:—(Fauvel, 1882). *Nord*:—Forêt de Raismes; Dunes de Calais (Lethiery) (Fauvel, 1882). *Oise*:—Senlis (A. Pholin); (Bedel, 1881). *Orne*:—Domfront (Fauvel); (Fauvel, 1882). *Pas de Calais*:—Calais (Bonard); (Bedel, 1881). *Puy de Dôme*:—(Baudet-Lafarge, 1836). *Pyrenees Orientales*:—(Pellet); (Bedel, 1881). La Massane (Mayet); (Fauvel, 1882). *Rhône*:—(Fauvel, 1882). *Sarthe*:—(Desportes); (Houlbert, 1903). *Seine*:—Bondy; Bois de Boulogne; Bois de Clemart; Vincennes (Desmarest); (Bedel, 1881). *Seine et Oise*:—Bois de Meudon (Ch. Brisout de Barneville); Forêt de Marly (Ch. Brisout de Barneville); (Bedel, 1881).

Paris (Latreille, 1804); (Dejean, 1821). Pierrelaye (Boudier); (Bedel, 1881). Puteaux (Fauvel, 1882). Forêt de St. Germain (Ch. Brisout de Barneville); (Bedel, 1881). *Seine Inférieure* :—Parc de Petit-Quevilly (Derote); (Bedel, 1881). Forêt de Roumare (Rossignol); (Fauvel, 1882). *Somme* :—Bois de Boves (Le Corr); (Bedel, 1881). Bois de Caux (Marcotte, 1852). Forêt de Crécy (d'Halloy); (Bedel, 1881). Forêt de Crécy (Marcotte, 1852). Bois du Gard (Garnier); Bois de Querrieux (Garnier); (Bedel, 1881). *Vaucluse* :—Avignon; Viaduc de la Durance (Fabre); (Fauvel, 1882). *Vosges* :—(Wencker); (Fauvel, 1882). *Yonne* :—St. Sauveur (Robineau-Desvoidy); Sens (Julliot); (Bedel, 1881). Sens (Loriferne); (Fauvel, 1882).

GERMANY. (Dejean, 1826). Berlin (Bowring), (Ruthe), (in Eur. Coll. Brit. Mus.). Halle (Nicolai, 1822). Heidelberg (Maehler, 1850). Hildesheim (Wilken, 1867). Harz Mts.; Kyffhauser Mts.; (Hornung, 1844). Grafschaft Hanau-Munzenborg (Bergstrasser, 1778). Karlsruhe (Holste, 1915). Saxony. Thuringia (Kellner, 1873). *Upper Silesia* :—(Kelch, 1846). (Letzner, 1850). Beneschau; Bielgut near Oels; Birnbäumel; Breslau (Promenade, Scheitnicher Park, Oswitz, Meffelwitz); Friedeberg; Gorlitz; Johannisberg; Kanth; Leignitz; Leobschutz; Liffa; Niesky; Ohlan; Polnisch Hammer; Ratibor; Schweidnitz; Schwoitsch; Strachate near Trefchen; (Letzner, 1850). Wurtemburg (Roser, 1838).

GREECE. Aetolian Mts. (Kiesenwetter); Parnass (Krupov); Sporaden (Reiser); (Apfelbeck, 1904).

HOLLAND. (Voet, 1793). Apeldoorn; Valkenburg; (Everts, 1898).

HUNGARY. Papa (Horvath).

ITALY. (Villa, 1833). Lombardia (Villa, 1844). (Griffini, 1894). Bozen; Haslach; (Gredler, 1863).

JUGO-SLAVIA. Bosnia; Herzegowina; Montenegro—Rjeka (Mustajbig); Serbia—Goluboval (Merkl); Majdan (Kutschaina); Negotin; Tekkia; (Apfelbeck, 1904).

NORWAY. (Born, 1927). Fridrikshald in Rodparken (R. Collett); (Siebke, 1875).

PERSIA. Astrabad (Coll. Mus. Vindob.); Kopet Dagh (Coll. Mus. Vindob); (Breuning, 1927). Poucht-é-kouh (Lapouge, 1912).

POLAND. Galicia (Lomnicki, 1894).

PORTUGAL. (Fuente), (Breuning, 1927). Serra d'Estrella (Abbé Saraiva); (Oliveira, 1887). (Bedel, 1881).

ROUMANIA. Valley of Berlâd (Montandon); Commana Vlasca (Lapouge, 1930).

RUSSIA. (Fischer, 1925-28); (Dejean, 1837). Caucasus (Bedel, 1895). Adzikend (Vasil); Chram; (Leder); Daracicag (Dobr); Lagodechi (Vin-Nik); Majkop (Schaposchnikov); Pjatigorsk (Semenov); Sarjal (Kolenati); Soci-Tuapse (Reit-

ter) ; Stavropol (Lutschnik) ; Susa (Koenig) ; (Zaitzev, 1918). Circassien (Reitter) ; Erivan (Maljushinko) ; Kuban (Jacobson) ; Talysch (Ménétries) ; Terek (Lutschnik) ; (Breuning, 1927). Kasan (Jacobson) ; (Breuning, 1927). Kharkov (Motschulsky, 1850). Lenkoran (Ménétries, 1832). Moskau (Jacobson) ; (Breuning, 1927). Pskow (Jacobson) ; (Breuning, 1927). Transcaucasus (Faldermann) ; (Chaudoir, 1846). (Kolenati, 1845). Voronezh (Langhoeffer, 1926).

SICILY. Ficuzza (Ragusa, 1883, 1905).

SIBERIA AND MANCHURIA. (Ganglbauer, 1892). Chabarowsk (Coll. Breuning) ; (Breuning, 1927). Region of the Amur. (Bedel, 1895). Sutschau (Coll. Breuning) ; (Breuning, 1927). Usuri (Csiki, 1927). Vladivostock (Kraatz) ; (Breuning, 1927).

SPAIN. (In coll. Chevrolat in Hope Dept.). (Fuente), (Breuning, 1927). Alicante (Escalera, 1926). Escorial ; Cordillera de Gredos ; Herreria ; Madrigal ; Piedralobes ; (Escalera, 1924).

SWEDEN. Calberg (Paykull, 1790). Fredriksdal (Muller, 1764).

SWITZERLAND. Basle (Heer, 1838). Bundten (Umstein in Fuesslins, 1775). Ct. Zurich ; Geneva ; Lausanne ; Schaffhausen ; Thurgau ; (Heer, 1838).

SYRIA. Amanus (Chapman, 1922). Antilibanon (Piochard) ; (Breuning, 1927). Bois de Hibbaryeh on the hills of Djebel-ech-Cheik. (Brulerie, 1875). Beyrut (Kraatz, 1877). (Chapman, 1922). Province of Constantine (Bedel, 1881).

TUNIS. Ain-Draham (Schädelin, coll. E. Lefèvre) ; El-Fedja (Ch. Martin) ; (Bedel, 1895).

HABITAT.

Calosoma inquisitor appears to be confined to areas bearing broad-leaved trees upon which it hunts caterpillars, its main source of food. Linnaeus (1758) records it 'in Europae arboribus larvis Papilionum Phalaenarumque victitans,' and (1761) 'in sylvis, cursitans per plantas noctu.' Other observers record it chiefly on the trunks and branches of oaks, but also on beech, birch, black currant, broom, hawthorn, hornbeam, maple, osiers, pear trees and bracken, during the period from April until July. It has also been found in the earth, under stones, decaying leaves and moss and sometimes at sugar. Although associated with these plants the beetle is entirely carnivorous and has not been observed to eat any vegetable matter. Norman (1844) records it in Hainault Forest on oak and hornbeam, particularly the trunks of the latter, which were covered with foliage down to the ground ; over four hundred specimens were taken in one day. Hodgson (1822) took more than one hundred specimens ; the majority of these were on the ground or on trunks and branches, but some were seen flying in the sunshine. The species

appeared to be very local and was found only in a comparatively small area. Barthe (1909) states that when in flight it is often raised to a high altitude by atmospheric currents, thus accounting for a single specimen found at the summit of the Plomb du Cantal (1868 m.), in central France, and another at over 2,000 m. on the Pic de Nère, near Barèges, in the Hautes Pyrénées, France.

LABORATORY EQUIPMENT FOR EXPERIMENTAL WORK.

Beetles taken in the hibernating state in September, 1934, were placed in fine soil contained in half-filled gauze cylinders of nine inches in diameter and eighteen inches in height. These cylinders were partially buried in the ground out-of-doors so that the level of soil inside them was equal to that of the ground surface outside. The beetles soon burrowed down into the soil and made fresh hibernating cavities. In the following spring eighty per cent. of the beetles emerged from hibernation without having suffered any visible ill-effects as a result of being disturbed. After emergence pairs of beetles were confined in glass jars with gauze coverings, and in rectangular wooden or tin boxes of approximately ten inches in length, eight inches in width and six inches in height, with detachable glass tops. Fine soil was placed in these containers to a depth of about 4 in. with small leafy oak twigs scattered over the surface. About fifty beetles were confined together in eighteen-inch cubical boxes of wood with gauze and glass panels. The depth of soil varied in each cage from one to six inches. Small leafy oak branches upon which the beetles could climb were placed in the cages and a layer of leaf litter was scattered over the soil surface. Caterpillars and pupae for food were introduced on glass plates which were laid on the soil surface. These were easily washable, and by their use the soil was kept clean and wholesome. The beetles appeared to have no difficulty in finding and devouring the food at once. When the supply of caterpillars became scarce, fresh raw meat containing much blood was substituted; beetles also found this readily and proceeded to suck out the juices. Small shallow vessels filled with water were placed in the cages and beetles were often to be seen drinking the water, more especially after the supply of caterpillars had failed and raw meat was substituted. When the soil became rather dry, water was lightly sprinkled on it, and thus a more or less continual state of dampness was maintained.

SOIL REQUIREMENTS IN EXPERIMENTAL WORK.

Very dry or sandy soil is unsatisfactory because eggs and pupae may be crushed by collapse of the chambers in which they lie and the adults are unable to excavate cavities for hibernation. Very damp soil may cause the particles composing the walls of

the pupal chamber to adhere so strongly to one another that the adult is unable to escape on hatching or after hibernation. Damp soil sometimes adheres to the limb-joints and mouth-parts of beetles and subsequently hardens, thus greatly restricting movement and causing starvation. A loamy clay seems to be most suitable for use in experimental work with these insects.

Nature of the Operations of *Calosoma inquisitor*.

As far as investigations have proceeded, it may be said that this beetle in both the larval and adult stages is wholly beneficial to man.

In experimental work large numbers of caterpillars and pupae are eaten, and under natural conditions similar activity also takes place. The larvae frequent the ground and consequently are chiefly concerned with the destruction of larvae and pupae found there. The ability of the adults both to climb and to fly makes them a potent factor in the destruction of larvae which may be defoliating the trees. During investigations carried out at Astonbridge Inclosure in the Forest of Dean, hundreds of adult *Calosoma inquisitor* were observed ascending the trunks of oak trees at dusk, searching the branches for caterpillars, which they quickly devoured. These observations in an area of defoliated oak trees serve as an illustration of the potential destructive power of *Calosoma inquisitor*. With the knowledge of the quantity of food required per beetle under experimental conditions in the laboratory, it is possible to understand the great destruction which even a small number of these beetles would be able to accomplish under natural conditions.

Summary of Life-History.

This summary is based on the work of Burgess and Collins (1917), the only detailed investigation into the life-history which has hitherto been made, although Escherich (1914) and Holste (1915) have made contributions on the subject.

The eggs are laid in egg-chambers in the soil during early summer, and the duration of the egg stage varies from 8 to 14 days according to temperature. After hatching, if the weather is warm, the larvae soon make their way to the surface of the ground in search of food. Larvae undergo two ecdyses, and the average duration of larval stages for first stage is 8.6 days, second stage 6.6 days and third stage 8.7 days; the activity of larvae and interval between ecdyses being largely influenced by temperature and food supply. Larvae do not climb trees in search of food, but feed on various species of caterpillars and pupae occurring on the ground; they are prone to cannibalism. The prepupal stage averages six days, during which time the pupal chamber is constructed in the ground at depths varying

according to hardness. The pupal stage lasts for about twelve days and the beetle emerges from the pupa in autumn, but remains in the pupal chamber and does not come to the surface until the spring.

The Adult.

Description of Adult.

Colour variable, ranging from metallic green, bronze or almost black to violet. Of two distinct sizes; larger average size, length 18.5 mm., width 9.0 mm.; smaller average size, length 16.5 mm., width 7.5 mm.

Head (Pl. VII, fig. 4). Coppery, sometimes greenish, especially on the sides; rather wide, not contracted behind the eyes, produced in front, neck inflated, not constricted; rugosely punctate with two longitudinal depressions between the antennae and with a single supra-orbital setigerous puncture on each side. Clypeus narrow, bisetose; frontal foveae extending along the sides to near anterior margin; fused posteriorly with frons. Labrum short, bilobed, rather wider than clypeus, deeply emarginate in front; plurisetose medio-anterially, and with a single large setigerous puncture on each side lobe. Mandibles (Pl. VII, fig. 8), black; long, powerful, slightly curved distally, more or less pointed, concave; plurisetose meso-ventrally, with a rather blunt tooth near base; front half of upper surface with rather coarse slightly oblique transverse striation. Maxillae (Pl. VII, fig. 7), strong, densely fringed with hairs along inner margin and over the whole of the rounded apex; with a fine sharp glabrous tooth at right angles to limb just below apex on inner side; cardo and palpifer each with one seta and stipes with two. Four black stout maxillary palpi, slightly dilated distally and incrassate at apex. Internal maxillary palpi projecting beyond apex of maxillae and composed of two segments. External maxillary palpi with basal segment small, second segment elongate and clavate, third and fourth equal or third longer than fourth; the fourth truncate. Mentum (Pl. VII, fig. 5), short and broad, bilobed, emarginate; usually with a seta on each side of the base, lobes gently rounded laterally. Submentum (Pl. VII, fig. 5), short, as broad as the mentum; with a row of setigerous punctures near anterior margin. Gula long and narrow, extending ventrally from the submentum to the posterior margin of the head, and separated on either side from the genae by gular sutures; submentum and gula fused to form the gulamentum. Two long and stout black labial palpi, slightly dilated distally, incrassate at the apex; three-segmented, borne on palpigers which resemble the basal segments of the palpi; basal segments short and curved, second segments elongate and clavate, with four or five setae on the inside, third segments securiform and truncate. Glossa (Pl. VII, fig. 5), small, truncate or arcuate at apex and plurisetose, the two middle setae

longer than the others; paraglossae narrow, not so long or wide, contiguous with and superimposed on the glossa, adnate, finely setose, membranous, separated from glossa at apex by a slight emargination. Eyes (Pl. VII, fig. 4), yellowish-brown; rounded, prominent, distant from buccal fissure. Antennae (Pl. VII, fig. 6), filiform, lateral, inserted in front of and close to anterior margin of the eyes; slightly shorter than half the body and reaching beyond the base of elytra; eleven-segmented with second segment shortest, third longest, both compressed, trenchant exteriorly and with sharp edge along posterior margin of upper surface; first and fourth sometimes with a feeble edge; first four segments black, others brownish and pubescent, slightly tapering distally, apices fuscous; terminal segment slender and sub-linear; first segment with a single setigerous puncture on upper surface; apices of all segments except first and second sparsely encircled with setae.

Pronotum. Coppery with greenish margins, shining, rugose-punctate; at widest point almost twice width of head, short, half as long as broad, dilated at sides, strongly rounded and contracted towards base, more or less bordered, border obliterated before base, base slightly sinuate, margins elevated and more coarsely punctured and rugose; on each side near the margin with a setigerous puncture mid-way between anterior and posterior margins. Posterior angles sometimes flattened, generally deflexed and somewhat produced backwards, at base a shallow central furrow and two large foveae, sometimes each containing a setigerous puncture.

Meso- and Metanotum (Pl. IX, figs. 13 and 14). Black; entirely covered by the elytra except mesoscutellum. Mesonotum much reduced, composed of prescutum, scutum and scutellum. Scutellum small, short, triangular, slightly ridged, dividing scutum into two separate plates. Postnotum wanting. Metanotum well-developed and undulating; composed of prescutum, scutum, scutellum and postnotum; sclerites strongly fused and somewhat setaceous.

Legs. Black, cursorial, long, powerful. Femora subcylindrical, profemora stouter. Tibiae slightly incrassate towards apex, each with two spines distad. Protibiae sulcate, gradually broader to tip, slightly grooved within, spines terminal, but placed obliquely to each other. Mesotibiae slightly arched in male, nearly straight in female, setose in front and behind; metatibiae setose in front in male. Tarsi (Pl. VI, figs. 2 and 3), five-segmented with a double row of spines beneath; protarsi shorter than long and slender meso- and metatarsi. Protarsi of male with first four (first three very strongly, fourth often less) anterior segments dilated and pubescent beneath. Apical claws, simple, curved and smooth.

Wings (Pl. VIII, fig. 11). Of the normal Adephaga type,

each with eight principal veins: costa, subcosta, radius, media, cubitus, 1st anal, 2nd anal and 3rd anal, of which the radius, media and cubitus are branched. The branches of the media are connected by two transverse veins, thus forming an oblong cell characteristic of the type.

Elytra (Pl. IX, fig. 13). Metallic, coppery or brassy bronzed, black with brilliant green margins; generally rectangular, at widest point nearly twice width of thorax, dilated behind, feebly embracing sides of body; well-marked shoulders, rounded apex in male, rather pointed in female; narrowly bordered without basal border, border generally serrate behind shoulder. Epipleurae moderately broad at base. Regularly striate longitudinally and irregularly striate horizontally, normally sixteen or eighteen reticulated striae, interstices transversely strigose. Each elytron with a very fine sutural stria generally present, and one stria originating in the marginal channel at a third from the base. Each elytron with three rows of deep concolorous impressions placed between fourth, eighth and twelfth striae from the suture, the intervals of about equal width, each puncture minutely tuberculate, generally three, sometimes five, intervals between primary impressions, secondary impressions similar to primary ones occur sporadically. Marginal channel and apex minutely tuberculate.

Pro-, Meso- and Meta-sternum (Pl. VIII, figs. 9 and 10). Greenish-bronze. Prosternal process more or less bordered, produced over mesosternum, nearly vertical and subcarinate anteriorly, hollowed in the middle and narrowly emarginate posteriorly; anterior coxal cavities open, posterior contiguous; metasternal epimera invisible; metepisterna narrowed posteriorly, slightly longer than wide.

Abdomen (Pl. IX, figs. 15 and 16). Shining bronze to greenish in colour, sub-quadrate, broad and convex. Six visible sternites, bordered, border not reaching sides, third and fourth more or less setose mesad, fifth and sixth generally with one or two sub-median setae on each side, apical segment with distal margin plurisetose.

Sexual dimorphism. Both sexes closely similar, varying in colour considerably as well as in size, male generally smaller than female. Male alone having dilated protarsal segments, spongy beneath. Mesotibiae slightly arched in male, nearly straight in female, metatibiae fringed with setae in front in male. Elytra appear parallel-sided in male, more ovate in female; apex of elytra more broadly rounded in male, less so in female. Last sternite more broadly rounded in male, less so in female.

The Alimentary Canal (Pl. IX, fig. 12). The alimentary canal is slightly greater in length than the insect's body and has its three primary divisions, stomodaeum, mesenteron and proctodaeum easily distinguished.

Stomodaeum. In the fore-intestine several distinct regions are recognized. The pharynx is the slightly dilated portion just posterior to the mouth, connecting the latter with the oesophagus. The oesophagus is a simple straight thin-walled tube which traverses the caudal part of the head and the fore-part of the prothorax, connecting the pharynx with the crop. The crop is a dilatation of the tract immediately posterior to the oesophagus and lies in the hind-part of the prothorax and anterior portion of the mesothorax. It functions as a food reservoir. The gizzard or proventriculus lies immediately posterior to the crop and acts as a grinding organ in which the food is prepared for entrance into the more delicate digestive organs. The oesophageal valve occurs as a constriction of the tract at the junction of the fore- and mid-intestine, immediately posterior to the gizzard. It has been suggested that its presence prevents regurgitation. Both gizzard and oesophageal valve lie in the posterior portion of the mesothorax.

Mesenteron. The mid-intestine or stomach is tubular in shape, its surface being covered with small sac-like diverticula — the enteric or gastric coeca. Towards the posterior region there is a gradual decrease in the size of the stomach and a diminution in the number of coeca. It is bounded anteriorly by the oesophageal valve and posteriorly by the pyloric valve where it joins the hind-intestine.

Proctodaeum. In the hind-intestine three regions are present; the small intestine or ileum, the large intestine or colon and the rectum, but delimitation between ileum and colon is hard to distinguish. At the junction of the mid- and hind-intestine are the pyloric valve and Malpighian tubes. Four slender Malpighian tubes arise separately at equal intervals around the circumference of the tract and extend over the region of the junction of mid- and hind-intestine; their length varies between forty and fifty centimetres. They appear to unite distally in pairs; fusion of all four together does not appear to take place. The ileum is the anterior portion of the hind-intestine, lying in the fourth abdominal segment and connecting posteriorly with the colon, a tortuous tube leading to the rectum. The rectum is large and oval in shape and lies in the fifth and sixth abdominal segments; rectal pads are present at the anterior end. It connects the colon with the anus, which is the posterior opening of the alimentary canal.

The Anal Gland and Anal Gland Reservoir (Pl. IX, fig. 12). Dorsad to the rectum are two anal glands, connected by a thin tortuous tubule to the kidney-shaped anal gland reservoirs which lie on either side of the rectum. Each anal gland reservoir is joined to a duct whose distal opening is attached to the margin of the ninth tergite. These anal glands are of a complex structure and secrete pungent properties which appear to be con-

artificial system of classification by interlacing circles, which he says (Vol. 2, p. 165) is "possessed of a symmetry and unity superior to anything we can conceive, even on the very slight glimpse which I am able to give of it—and finally that so far is this plan from militating against the doctrines of revealed religion, that it will be found to depend on these as some of its very best supports."

Macleay's doctrine found special favour with Kirby and Spence, the fathers of British Entomology, from whom I have already quoted. Kirby himself communicated in 1822 (17) an account of insects which resembled others not nearly related and wrote "and we shall find the further we extend our researches, the traces of that plan of CREATIVE WISDOM by which a *symbolical relationship*, if I may so call it, connects such of his creatures, as in other respects are placed in opposition to each other, as well as a *natural affinity* those that really approximate."

Westwood (18) in a paper read in 1837 harped on the same theme of affinity versus analogy in describing a species of grasshopper which so resembles one of the active predatory Tiger beetles (*Cicindelidae*) that he was himself deceived. This example is particularly to the point for we should now recognize it as Mimicry, while there is no reason to suppose that such an explanation applies to the examples given by Kirby. It was probably this current view of "Analogy" everywhere that caused Bates to use the term "Mimetic analogy" in his new theory which we shall discuss in a moment.

Gosse (*loc. cit.* p. 145) also noted the wonderful likeness of Clear-wing moths to Hymenoptera, but attempted no explanation or comment. "How very *hymenopterous* many of the Aegeriae are! The similarity is not confined to shape . . . . the most usual colours are black banded with yellow, with white, sometimes with orange or scarlet,—all hymenopterous colours." In movements and flight they are "so much like the waspish tribes, that . . . . I have often been deceived."

We have now reached this stage in our survey—that a beneficent Nature had provided that creatures could escape their enemies by concealment, or by threats of retaliation, but no one could explain the likeness between unrelated insects except as an example of some mysterious deep principle of analogy which was supposed to give pleasure to the Creator and might in some cases enable one insect to live at the expense of another.

But in 1858, like a ray of sunshine penetrating fog, came the Darwin-Wallace essay with its formulation of the principle of

served in the anal gland reservoirs and ejected through the anal gland ducts when the beetle is disturbed or excited.

Female Genitalia (Pl. X, figs. 19 and 20). On either side of the alimentary canal, a single ovary is present, each being connected by a fairly short oviduct to the uterus which lies ventrad to the alimentary canal. Dorsad to the uterus lies the bursa copulatrix which is a pouch-like outgrowth of the distal end of the uterus. At the point of fusion and between the bursa copulatrix and uterus arises the tubular spermatheca which extends anteriorly almost to the proximal end of the uterus. The distal portion of the uterus is sheathed in a membranous and chitinized armature comprising the valvifers, coxites and styli and the eighth, ninth and tenth abdominal segments. The eighth sternite is the most ventral and consists of a strongly chitinized oval plate prolonged anteriorly on either side of the uterus, and divided medianly by membrane. The ninth sternite is membranous, slightly pigmented and setaceous on anterior margin and reflexed from the posterior margin of the eighth sternite to the anterior margin of the valvifers. The tenth sternite is represented by two small narrow plates adjoining the inner margin of the coxites anteriorly. The eighth tergite is strongly chitinized, retracted somewhat under the seventh tergite, bearing a small spiracle on either side, with two small sub-medium indentations on the anterior margin. The ninth tergite is a strongly chitinized oval plate fringed with setae on the posterior margin, lying dorsad to the tenth tergite, anus and the styli. The tenth tergite is membranous, slightly pigmented on anterior margin and reflexed under the ninth tergite, holding the anus in position. The valvifers are strongly chitinized concave plates whose interior margins support the coxites and are held in place posteriorly by the ninth tergite. The coxites are chitinized and membranous, densely setose ventrally, and bearing posteriorly the one-segmented, chitinized and setaceous styli.

Male Genitalia (Pl. X, figs. 17 and 18). The male reproductive organs consist of the testes, which are simple, closely coiled and tubular, lying on either side of the alimentary canal, and the vasa deferentia bearing the long coiled tubular vesiculae seminales. Posteriorly the vasa deferentia unite to form the ductus ejaculatoris which terminates in the aedeagus. The aedeagus itself consists of a median lobe and tegmen. The median lobe is elongate and curved, containing an internal sac which is everted through the median orifice during coitus. The tegmen is composed of membrane strengthened by chitinous sclerites and the lateral lobes which hold the median lobe in position. The apex of the aedeagus is evaginated between the ninth and tenth sternites. The eighth sternite is reduced to a membrane and two chitinized marginal plates. The ninth sternite is also membranous, but with two chitinized hoops and the oval piece.

The tenth sternite is membranous and lies between the aedeagus and the anus. The eighth tergite is a broad chitinized plate, membranous in the middle and at the sides, partly retracted under the seventh tergite with a small spiracle on either side near the anterior margin. Ventrad to and concealed by the eighth tergite is the narrow chitinized ninth tergite lying dorsad to the small membranous tenth tergite reflexed beneath which holds the anus in position.

Aberrations and Monstrosities. Jennings (1902) gives a short description of the blue aberration found by him and also by R. W. Lloyd in the New Forest, while it is recorded at Rhamnor in the New Forest by P. Harwood. A. Ford has found ab. *coeruleum* and ab. *viridimarginatum* in the New Forest as recorded by W. J. Fordham *in litt*. Asmuss (1835) and Frivaldsky (1886, 1889) have briefly described three abnormal specimens found in Europe.

Habits. The beetles are very agile on trees and appear to prefer climbing to running on the ground. They search for their prey in trees, destroying defoliating caterpillars. There is no evidence that they attack insects other than caterpillars except for the record in Kirby and Spence (1823), where *Calosoma inquisitor* is mentioned as an enemy of *Brachinus crepitans* L. (Col.). Holyoak (1871) suggests that collectors would find more specimens if they examined the trunks of oak trees at dusk, believing that the *Calosoma* beetles ascend the trees at night in search of food, returning in the early morning to hide.

Length of Life. Adults of *Calosoma inquisitor* have been proved by Burgess and Collins (1917) to live up to three years.

Hibernation. In two years, Burgess and Collins (1917) in the United States observed that beetles ceased feeding between 27th June and 12th July in order to enter hibernation. The size of the hibernation cavity is about 2 cms. in diameter, while the depth ranges from 1 to 40 cms., although most of them are found from 1 to 15 cms. below the surface.

Mortality during Hibernation. Under laboratory conditions about twenty per cent. of the bettles were found to have died during hibernation.

Effect of Curtailing Hibernation. Four pairs of beetles were removed from hibernation on 19th April, but at no time did they appear fully active and this early awakening seemed to have a lasting detrimental effect upon them. Before caterpillars were available, larvae of Melolonthidae (Col.) and Tipulidae (Dipt.) were given, but although the beetles fed upon them readily enough at first, their appetites gradually decreased. The subsequent offering of caterpillars failed to increase their vitality, and after consuming a few *Tortrix* larvae (Lep.) the beetles refused to eat and on 2nd June burrowed into the soil. Although frequently disturbed and always well supplied with a variety of

food, they persistently refused to eat and all died during the last week of June.

Emergence in Spring. The beetles emerge from hibernation in the spring, usually during the first week of May, but earlier if the weather is warm and later if cold.

Feeding Habits. The adults climb trees, preying upon caterpillars, which are seized in the middle of the back and held firmly in the mandibles while the juices are absorbed.

Length of Feeding Period. The feeding period extends from the time of emergence from hibernation until about two weeks preceding entrance into hibernation, when they become rather inactive and consume but little food. The feeding period corresponds fairly closely with that of the caterpillars upon which they prey. In July, when caterpillars become scarce, the beetles feed less and spend most of the time beneath the ground, eventually burrowing to form a hibernation chamber.

Experiments in Feeding. Beetles readily attacked larvae of Melolonthidae and Tipulidae, sucking the juices for about an hour, at the end of which time all of them within the space of five minutes excreted a drop of blackish-green liquid. Raw meat was also successfully adopted as food and the juices were absorbed. Small earth-worms were attacked when food was scarce and the beetles were hungry, but under normal conditions they were ignored. No species of larva or pupa was ever entirely rejected as food, but some types were preferred to others as is indicated in descending order in the following list :—

1. Loopers .... . . most favoured.
2. Smooth larvae :
   (*a*) *Tortrix.*
   (*b*) Others.
3. Fairly hairy larvae.
4. Very hairy larvae.
5. Pupae .... less favoured.

The names of larvae, all Lepidoptera, forming the chief source of food in the laboratory are appended below :—

Acronycta rumicis L., *Bombyx neustria* L., *Calymnia trapezina* L., *Chaemotobia brumata* L., *Cynaeda dentalis* Schiff., *Diloba caeruleocephela* L., *Eupithecia abbreviata* Steph., *Hemithea aestivaria* Hb., *Hybernia defoliaria* Clerck., *Hybernia marginaria* Borkh., *Liparis monacha* L., *Phigalia pedaria* Fab., *Taeniocampa stabilis* View., *Taeniocampa miniosa* View., *Thecla quercus* L., *Tortrix viridana* L.

Beetles refused to eat slugs, snails, flies and vegetable matter.

Experiments to show the relative amounts of different kinds of foods consumed by *Calosoma inquisitor* were begun three weeks before the first beetle entered the hibernating stage. Altogether, fifty beetles were given special diets which remained

constant during the experiment, and the following averaged results were obtained :—

1 pair	ate	65 mixed larvae	in	25	days.
1 ,,	,,	79 *Tortrix*	,,	,, 26	,,
1 ,,	,,	86 looper	,,	,, 21	,,
1 ,,	,,	raw meat		for 32	,,

Burgess and Collins (1917) gave records of *Calosoma inquisitor* from the dates of emergence until the beetles entered hibernation; on the average each pair consumed 103 large caterpillars of the moth *Bombyx americana* Fabr. or of the moth *Porthetria dispar* L. Experiments carried out with three pairs of beetles during the active period from 10th May until 20th June gave an average consumption of 120 caterpillars of all kinds per pair.

In all the writer's experiments on feeding, water was also provided, and beetles, especially those fed on raw meat, were very often observed drinking. It is probable that the beetles were unable to extract as much liquid matter from the meat as they could from caterpillars and, therefore, made good the deficiency by a larger consumption of water.

It appears that the beetles locate their food by the sense of smell, for however well-hidden or camouflaged they were always quick to seek it out.

After feeding, they sometimes clean the antennae and mouth-parts with the front legs.

Starvation. Two pairs of beetles were subjected to starvation with the following results: in one instance the male devoured the female after two days and continued to live for another nine days before succumbing; in the other, the two beetles lived for ten days and then died within a few hours of one another.

Cannibalism. In captivity the beetles were inclined to attack one another whenever food was withheld from them during the active feeding season. Almost invariably the attacks were made on the posterior body segments, whence the body juices were sucked out, the maimed beetle eventually dying. In many cases the injured beetles were completely dismembered by the attacker, legs, wings and elytra being torn from the body. Further, it appeared that once a beetle had turned cannibal, it continued to attack others wantonly, and on several occasions such beetles had to be removed to protect the remainder. Careful observation showed that neither sex is particularly prone to cannibalism, the stronger overcoming the weaker irrespective of sex.

Reproduction and Number of Generations. Burgess and Collins (1917) obtained very variable results in their studies of the reproduction of *Calosoma inquisitor.* Frequently under laboratory conditions females do not reproduce for two successive

years. They stated that all the species of the genus *Calosoma* which they had investigated, including *Calosoma inquisitor*, have only one generation annually.

Polygamy. According to Burgess (1911) polygamy occurs in *Calosoma sycophanta*, and although no actual proof of it has been obtained in connection with *Calosoma inquisitor*, yet it seems very probable that it must take place in this species also.

Reaction to Heat and Cold. In all stages, temperature seems to exert a large influence upon the life-history of *Calosoma inquisitor*. Cold weather causes the adults to seek shelter underground, especially immediately after they have emerged from hibernation during an early and temporary warm spell. The higher the temperature, the greater is the food consumption and copulation occurs more frequently.

Reaction to Light. Beetles react strongly to light and in all circumstances observed, they are negatively heliotropic.

Habits of Flight. Undoubtedly *Calosoma inquisitor* can fly, as has been testified by Hodgson (1882), but when tossed up experimentally into the air, they fall to the ground without spreading their wings.

Drowning Experiments. Beetles survived immersion in water for over forty-eight hours with no apparent ill-effects.

NATURAL ENEMIES.

(*a*) *Predatory.* Among the natural enemies of the genus *Calosoma* in the United States, Burgess and Collins (1917) have recorded toads, skunks, foxes and racoons, and certain insectivorous birds, such as crows and woodpeckers; also a predacious bug *Podisus* sp., which was found feeding on a larva of *Calosoma sycophanta*. Kalmbach (1918) stated that the crow apparently consumed all species of *Calosoma*.

During investigations at Astonbridge Inclosure, Forest of Dean, the writer found many dismembered parts of beetles on the surface of the ground; this seemed to indicate that birds might be preying on the beetles, although they were never actually seen to do so.

(*b*) *Parasitic.* Few parasites of the genus *Calosoma* are known and the percentage infestation is always very small. No parasites of the adult *Calosoma inquisitor* have been recorded.

Burgess and Collins (1917) in the United States bred several Tachinidae from adults of *Calosoma calidum* Fab., *peregrinator* Guér., and *sycophanta*; these flies were originally determined as *Pseudatractocera calosomae* Coq., but were later identified as *Biomyia georgiae* B. and B. and more recently as *Vivania georgiae* B. and B. A discussion of the classification of these Tachinid parasites is given by Townsend (1916). Puparia, probably of the same species, have also been found in adults of

Calosoma calidum and *Calosoma frigidum* Kby. Felt (1912), Tothill (1913) and Aldrich (1905) also note *V. georgiae* as a parasite of *C. calidum* in the United States. Aldrich (1905) records *V. georgiae* as a parasite of *C. scrutator* Fab. and alludes (1915) to the Tachinid *Sarcophaga helicis* Towns. as a likely parasite of *Calosoma* larvae. Holste (1915) mentions *Phaenoserphus viator* Hal. as a parasite of the larvae of *Calosoma inquisitor* in Germany, and adds that larvae infested with this Proctotrupid do not pupate. Collins and Hood (1920) record the Tachinid *Eubiomyia calosomae* as a parasite of *Calosoma calidum* and *C. sycophanta* in the United States.

The writer found several specimens of the mite *Tyroglyphus longior* Gervais beneath the wings of two beetles which had been kept in captivity for some time, but it was impossible to establish their exact relationship with the host.

(*c*) *Fungi.* None has been recorded.

Factors affecting the Abundance of *Calosoma*

This is a question which has hitherto been almost entirely neglected, since the experiments and observations carried out on various species have been concerned mainly with their propagation as a means of controlling other insects. The species of the genus *Calosoma* are but rarely parasitized either as larvae or adults, nor do they appear to be subjected to serious attacks from birds and animals. In the active stages *Calosoma* are rapacious feeders and concentrate where the maximum supply of food is obtainable. When deprived of an adequate amount of food cannibalism occurs, while the desire for reproduction decreases and development is retarded, as has been seen in experimental work. The wilt disease of caterpillars is not transmitted to *Calosoma* even if badly diseased caterpillars are consumed. Contact insecticides used for the destruction of lepidopterous larvae do not materially affect the *Calosoma* beyond depriving them of their food. A warm early spring results in an early emergence from hibernation and, provided that food supplies have been similarly advanced by the warm weather, an increased period of reproduction follows. Conversely, a late spring curtails this period. During the active period, high temperatures result in greater activity, food consumption, development and reproduction than at low temperatures. In the hibernation period, beetles obtain protection from the cold by burrowing into the soil, and they are also able to withstand fairly long periods of immersion, as has been proved in the laboratory.

Economic Importance.

The economic value of *Calosoma inquisitor* does not appear to have been fully recognized until comparatively recent times,

although references to its powers as a destroyer of caterpillars were made by Linnaeus (1758), Bocks (1785), Letzner (1850), Taschenburg (1871), and by Judeich and Nitschke (1895).

Burgess (1911) recorded the importation of Swiss specimens of *Calosoma inquisitor* and *Calosoma sycophanta* into Massachusetts, U.S.A., in order to combat the gypsy moth and brown-tail moth pests. Burgess and Collins (1912) refer to similar importations, but state that only *Calosoma sycophanta* was successfully colonized. Escherich (1914) recognized the utility of *Calosoma inquisitor* and *Calosoma sycophanta* in destroying the larvae and pupae of the moths *Liparis monacha* L., *Bombyx pini* L. and *Bombyx dispar* L. Vassiliev (1914) in his work on an injurious insect *Otiorrhynchus* (*Cryphiphorus*) *ligustici* L. (Col., Curculionidae) named *Calosoma inquisitor* as a natural enemy. Burgess and Collins (1917) recorded several abortive attempts to colonize *Calosoma inquisitor*, both in adult and larval form, in Massachusetts, U.S.A. Silvestri (1923) and Mütze (1924) mention *Calosoma inquisitor* as a predator on *Tortrix viridana*. Escalera (1924) and (1925) reports the introduction of *Calosoma inquisitor* and *Silpha* (*Xylodrepa*) *quadripunctata* L. against *Lymantria dispar* and *Tortrix viridana* in Spain and against *Lymantria dispar* in Algeria. Delassus (1925) records the use of *C. inquisitor* and *C. sycophanta* against *Liparis dispar* in the Forest of Edough, Algeria, while Escalera (1926) reports the successful transportation of *Calosoma inquisitor* and *Silpha* (*Xylodrepa*) *quadripunctata* by aeroplane and postal services from Alicante to Algiers. Langhoffer (1926) gives *Calosoma inquisitor* as a natural control of the gypsy moth in the oak forests of Jugo-Slavia. Shchelkanovtzev (1929) states that an infestation in the forests of Voronezh by *Biston strataria* Hufn. (Lep., Selidosemidae) was partly subdued by *Calosoma inquisitor*, which was very abundant there. Veber (1932) drew attention to a new pest upon oak trees, *Coriscium brongniardellum* L. (Lep., Tineidae), the larvae of which are exposed to attack by *Calosoma inquisitor*. Burgeon (1933) acknowledged the economic value of *Calosoma inquisitor* and deplored its absence from the Belgian Congo.

In the three main areas in Great Britain where it is found at all frequently, the Forest of Dean, Hainault Forest, and the New Forest, *Calosoma inquisitor* is found in close association with the oak, a tree which has been much defoliated in recent years. In the Forest of Dean in particular, this insect can definitely be associated with the three main species of defoliating caterpillars, *Tortrix viridana*, *Chaemotobia brumata* and *Hybernia defoliaria*, and will invariably be found wherever these particular caterpillars are concentrated and a small area of oaks is in the process of mass defoliation. It is very localized in distribution even within a single forest.

The above observations demonstrate vividly the economic importance of *Calosoma inquisitor* as a potent factor in the control of the defoliating caterpillars of oak forests.

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natural selection and the preservation of favoured races in the struggle for life. There is no need for me to enlarge upon this theory; what I want to show you is how it brought new life to the study of entomology, revolutionizing the older views of conspicuous coloration which we have just been considering, giving it a logical place in a general scheme and opening the way to a continuous stream of observations and studies the result of which has been to strengthen the theory itself.

Natural selection has been much attacked during recent years, and has never been really popular with a number of scientists who therefore strongly criticize its application to the phenomena we are now going to discuss. Yet none of the critics of these phenomena can do more than produce volumes of destructive criticism—no explanation has yet been put forward which covers the facts of the coloration of insects so well as does the theory of natural selection.

The new ideas quickly found a devotee in H. W. Bates who, only three years after the publication of the "Origin of Species" applied them to the likenesses which he had noticed between insects quite distantly related (19). Very briefly, his theory is as follows: it was the first rational explanation of what we now call Mimicry, though Bates never used this term but talked of "Mimetic analogy" in the current phraseology. I have called attention to this phrase previously. Certain insects are endowed with such unpleasant characteristics that an enemy which has once attacked and tasted one will in future disregard others. This is not a new theory—it was the basis of older theories which we have just reviewed. Bates, however, went further. The enemy will remember the appearance of these nasty insects and, if there is abundance of other more palatable food, he will disregard any other insects the coloration or movements of which remind him of an unpleasant experience.

These questions of memory, and of preferences of one kind of food over the other lie at the very root of the whole phenomena of mimicry, but they are well established facts.

It is rather curious to reflect that the older views were capable of ascribing fossils to a mere whim of the Creator, who thought they might amuse or mystify mankind, but the same explanation was not thought of in connection with these deceptive resemblances among insects; although their presence was an accepted fact. No one had ventured to suggest that the Creator had arranged that certain species should escape because they resembled others known

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VEBER, YA. KH. 1932. [A new mass pest of oak trees. *Coriscium brongniardellum* L.] *Plant Prot.*, Leningrad, No. 2. 66. (*cf.*, 1933, *Rev. Appl. Ent.* (A), **21**: 622.) [*C. inquisitor* as a predator.]
VERHOEFF, C. 1893. Vergleich. Untersuch uber die Abdominal-segment und die Copulationsorgane der Mannlichen Coleoptera. *Dtsch. Ent. Z.*, **37**: 113-170. [Genitalia.]
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———— 1844. Catalago dei Coleopteri della Lombardia. Milano. 17.
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WALCKENER, C. A. 1802. Faune Parisienne, Insectes. Paris. **1**: 53. 2.
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WATERHOUSE, G. R. 1858. Catalogue of British Coleoptera. London. 5.
WEBER, F. 1801. Observationes Entomologicae, **1**: 20. [*Calosoma* genus introduced and described.]
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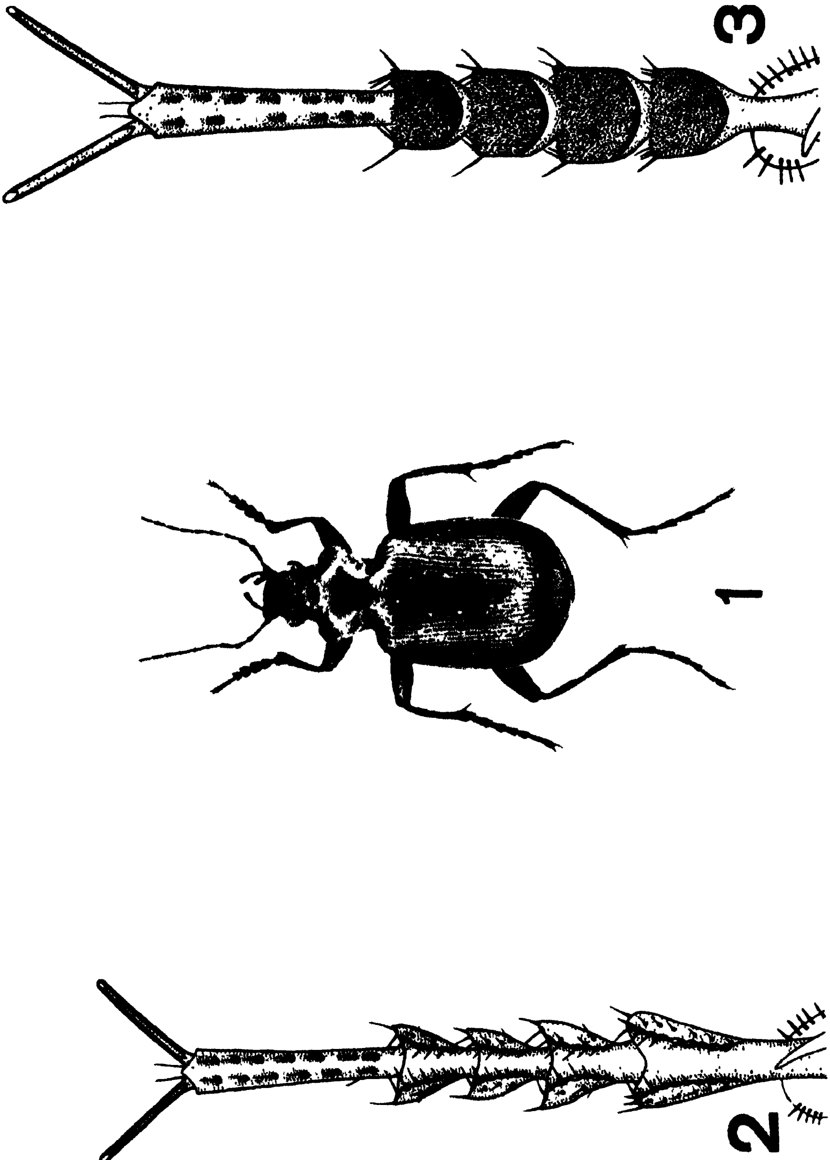
to be nasty, although Kirby and Spence were not so very far from this in their explanation of the bee-like *Volucella* fly.

The process by which these resemblances are affected will be clear to you: if, through the phenomena of variability a form is produced which even remotely suggests the appearance of an unpleasant species, it is possible that it may be disregarded when other more palatable food is easily obtainable. Thus it has a better chance of surviving to reproduce its like by the laws of heredity, and an initial slight resemblance may be perfected into the astonishingly detailed mimicry which so amazes every naturalist who has been deceived by it.

Darwin's delight at this prompt application of his theory is historic: he wrote to Bates in 1862 (20) that his paper was too good to be appreciated by the mob of naturalists without souls. This mob would have included the majority of entomologists of those days, of whom Darwin wrote to Meldola in 1877 (21) "I quite agree with you that it is a great pity that our entomologists should confine themselves to describing species." Bates' principles were soon applied by Wallace for Malay (22), Trimen for South Africa (23) and C. V. Riley for North America (24). The latter wrote a very spirited discussion of the new interpretation of the colours of insects which was warmly appreciated by Darwin who wrote to Riley (25) "The discussion on mimetic insects seems to me particularly good and original. Pray accept my cordial thanks for the instruction and interest which I have received."

I will quote to you from Riley's paper some remarks which give shortly what is really the whole pith of this address to you. "In no class of animals does the principle of adaptation to environment occur so generally and in such a striking manner as in insects. With them mimicry and other protective resemblances are almost universal, and it may be given as a rule that all insects living above ground, when not naturally protected by odour, luminosity or defensive covering such as hairs, spines, hard shelly wings, etc., or by armour such as stings, beaks, etc., either cover themselves with one substance or another, or similate their surroundings, or mimic either other animals, plants, or even inorganic substances. With insects in their larval states, will this rule especially hold good . . . . These striking resemblances were formerly looked upon, for the most part, as curious analogies in nature, intended to carry out the general plan of the Creator; but viewed in the light of modern science, and especially by that of the Darwinian development hypothesis, they have acquired an immense significance.

PLATE VI.

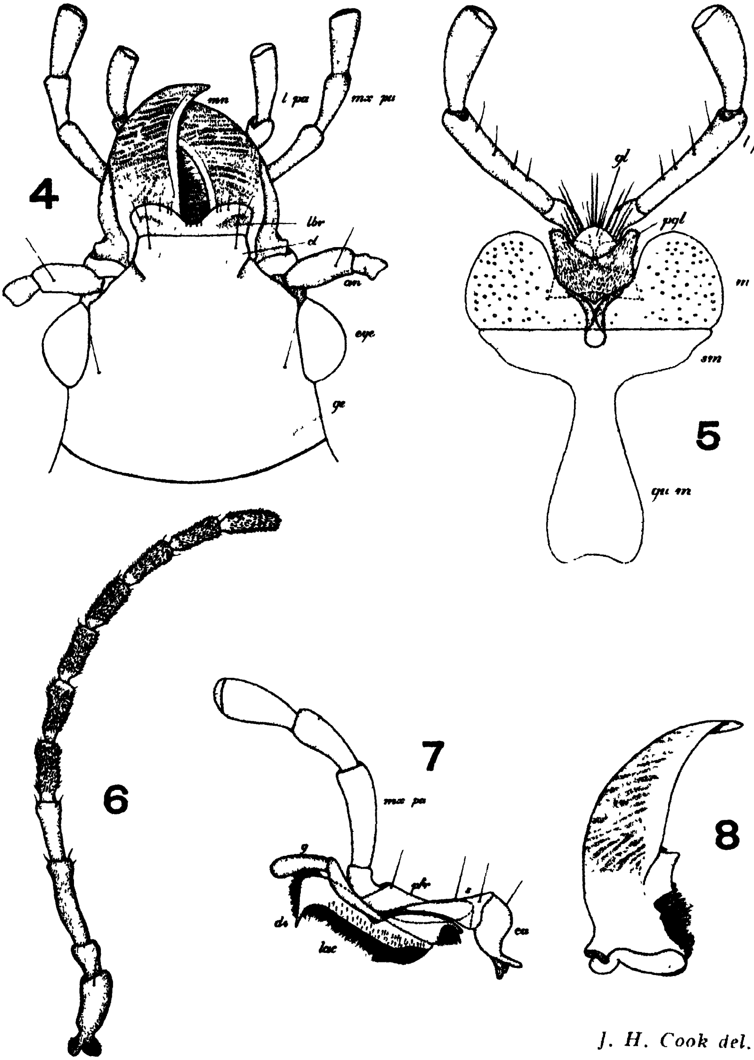


J. H. Cook del.

CALOSOMA INQUISITOR L.

FIG. 1. The adult male × 2.4.
FIG. 2. Tarsus of Female (ventral aspect) × 23.9.
FIG. 3. Tarsus of Male (ventral aspect) × 23.9.

PLATE VII.



J. H. Cook del.

CALOSOMA INQUISITOR L.

FIG. 4. Head. (dorsal aspect) × 9.7.
an, antenna; cl, clypeus; ge, gena; l pa, labial palp; lbr, labrum; mn, mandible; mx pa, maxillary palp.

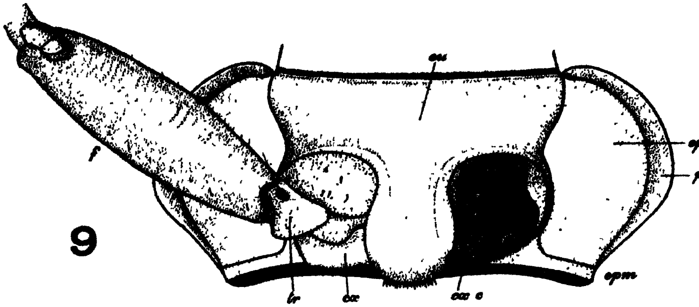
FIG. 5. Labium (ventral aspect) × 14.8.
gl, glossa; gu m, gulamentum; l pa, labial palp; m, mentum; pgl, paraglossa; sm, submentum.

FIG. 6. Antenna × 9.7.

FIG. 7. Maxilla (ventral aspect) × 14.8.
ca, cardo; di, digitus; g, galea; lac, lacinia; mx pa, maxillary palp; pfr, palpifer; s, stipes.

FIG. 8. Mandible (dorsal aspect) × 14.8.

PLATE VIII.



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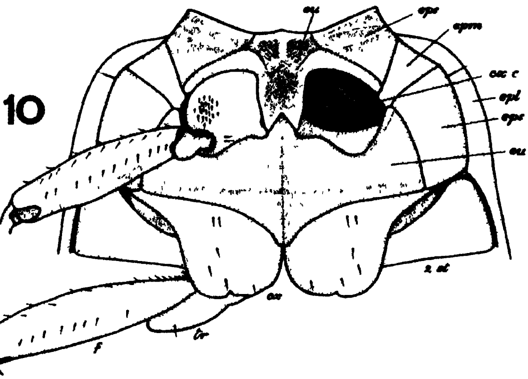

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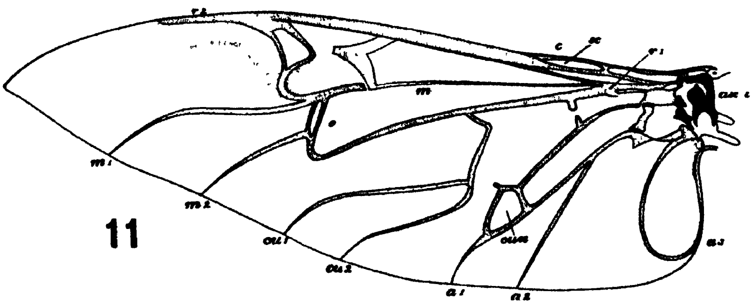


11

J. H. Cook del.

CALOSOMA INQUISITOR L.

FIG. 9. Prosternum (ventral aspect) × 9.7.
cx, coxa; cx c, coxal cavity; epm, epimeron; eps, episternum; eu, eusternum; f, femur; pn, reflex of pronotum; tr, trochanter.

FIG. 10. Meso- and Metasternum (ventral aspect) × 5.5.
cx, coxa; cx c, coxal cavity; epm, epimeron; epl, epipleuron; eps, episternum; eu, eusternum; f, femur; st, sternite; tr, trochanter.

FIG. 11. Wing (dorsal aspect) × 5.5.
a, anal; ax s, axillary sclerite; c, costa; cu, cubitus; cun, cuneus; m, media; o, oblongum; r, radius; sc subcosta.

PLATE IX.

FIG. 12. Alimentary Canal (dorsal aspect) × 5.5.

anu, anus; an gl, anal gland; an gl dt, anal gland duct; an gl rs, anal gland reservoir; col, colon; cr, crop; en c, enteric coeca; gi, gizzard; il, ileum; m t, malphigian tubes; oes, oesophagus; oes v, oesophageal valve; ph, pharynx; py v, pyloric valve; rct, rectum.

FIG. 13. Mesonotum (dorsal aspect) × 9.7.

ax c, axillary cord; ax s, axillary sclerite; el, elytron; psc, prescutum; scl, scutellum; sct, scutum.

FIG. 14. Metanotum (dorsal aspect) × 5.5.

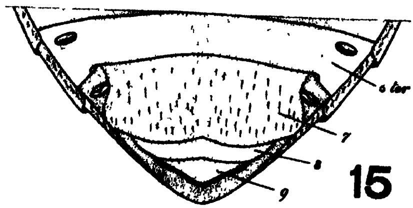
a n p, anterior notal process; a ph, anterior phragma; ax c, axillary cord; ax s, axillary sclerite; in m, intersegmental membrane; p n p, posterior notal process; p ph, posterior phragma; pst, postnotum (postscutellum); psc, prescutum: scl, scutellum; sct, scutum.

FIG. 15. Abdominal Tergites. Female. × 5.5.

FIG. 16. Abdominal Tergites. Male. × 5.5.

PLATE IX.

12



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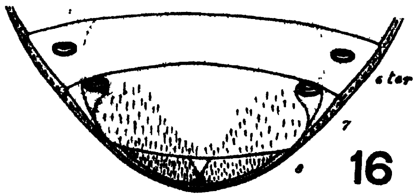

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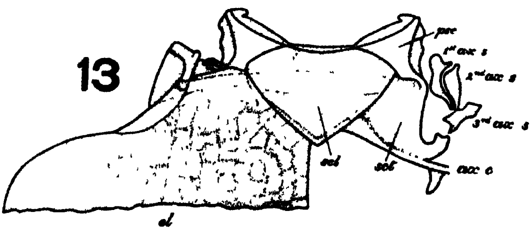

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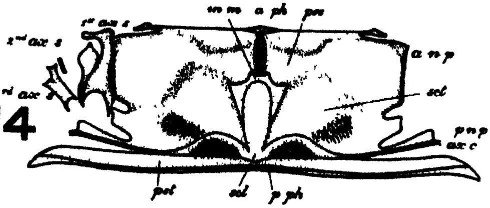


14

J. H. Cook del

CALOSOMA INQUISITOR L.

PLATE X.

FIG. 17. Male Reproductive Organs (dorsal aspect) × 9.7.

ae, apex of aedeagus; an gl rs, anal gland reservoir; d ej, ductus ejaculatoris; l l, lateral lobe; m f, median foramen; m l, median lobe; st, sternite; teg, tegmen; ter, tergite; tes, testis; vs df, vas deferens; vs sm, vesiculae seminales.

FIG. 18. Male Reproductive Organs (ventral aspect) × 9.7.

ae, apex of aedeagus; l l, lateral lobe; m f, median foramen; m l, median lobe; m o, median orifice; o p, oval piece; st, sternite; ter, tergite.

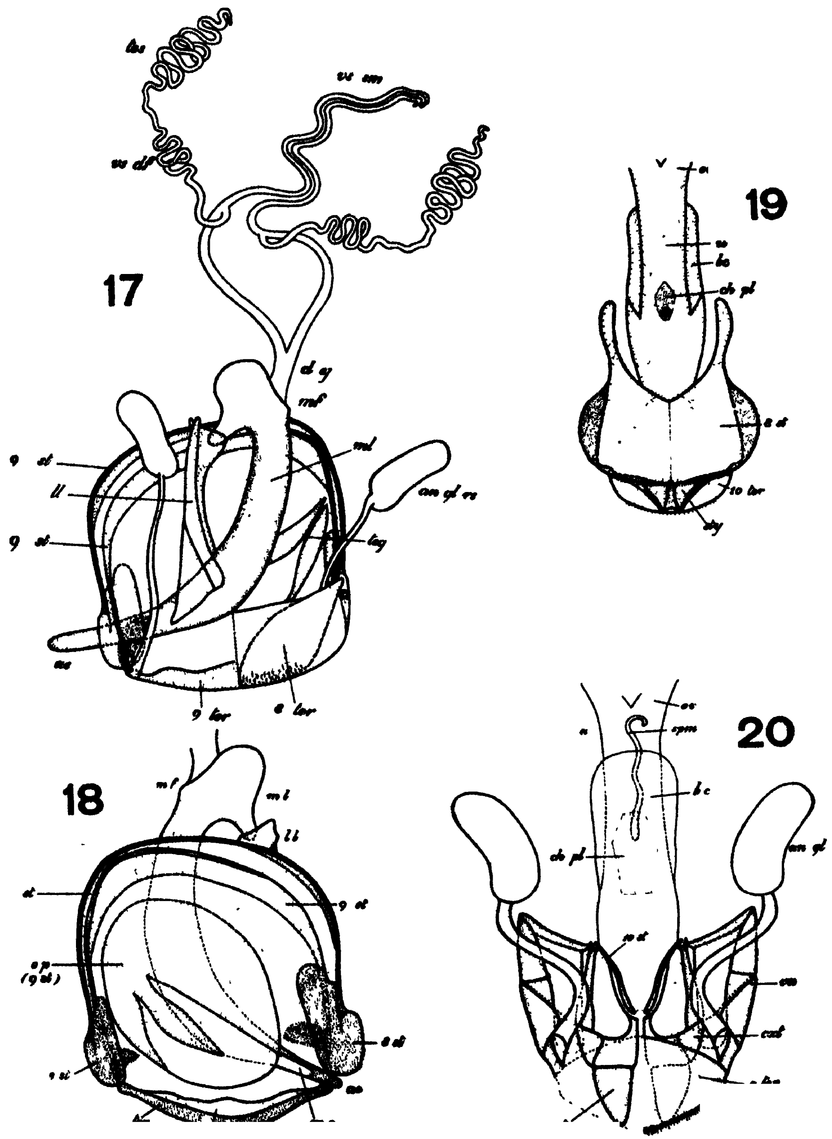
FIG. 19. Female Reproductive Organs (ventral aspect) × 5.5.

b c, bursa copulatrix; ch pl, chitinized plate; ov, oviduct; st, sternite; sty, stylus; ter, tergite; u, uterus.

FIG. 20. Female Reproductive Organs (dorsal aspect) × 9.7.

an gl rs, anal gland reservoir; b c, bursa copulatrix; ch pl, chitinized plate; cxt, coxite; ov, oviduct; spm, spermatheca; st, sternite; sty, stylus; ter, tergite; u, uterus; va, valvifer.

PLATE X.



J. H. Cook del.

CALOSOMA INQUISITOR L.

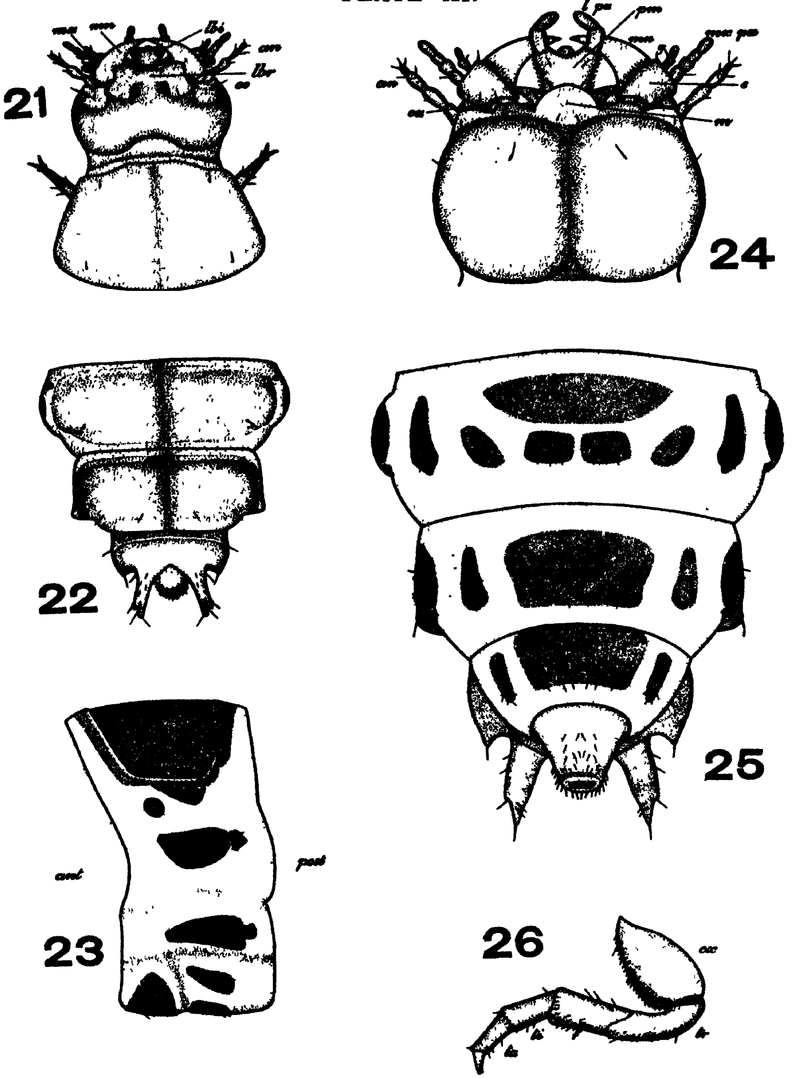
One of the most interesting phases of this mimicry . . . . is the imitation by an otherwise defenceless butterfly, of one whose great numbers and wide distribution indicate that it enjoys peculiar advantages. This specific imitation of one butterfly by another is precisely of the same nature as the mimicking of a vegetable or inorganic substance, and may consequently be just as properly termed mimicry."

I want you to note particularly the emphasis laid by Riley, as by Bates in his original paper, on the point that according to this new view the resemblance of one insect to another is just as intelligible as the resemblance of an insect to a plant: both are examples of resemblance to a particular part of the surroundings which is not attractive as food. This point is usually glossed over by critics who discuss mimicry as if it were something rare, highly special, fantastic, and without any parallel. Riley points out that the resemblance of one insect to another may be "just as properly termed mimicry." Nowadays we try to keep the term mimicry for the former class of cases only, which is in some ways a pity as it tends to emphasize the notion that it is a peculiar phenomenon.

Darwin, as Poulton has pointed out (26), was not so impressed by resemblance to plants as was Wallace, who had had more entomological experience in tropical forests; Darwin was more interested in bright colours. Rather a curious point here calls for notice, as I feel it has not been sufficiently stressed. Darwin much appreciated Bates' new views on mimicry, and yet does not seem at first to have thoroughly appreciated the importance of bright colours being associated with inedibility.

Indeed, I think that Bates himself did not; for although he discusses at length the resemblance of mimetic *Leptalis* to their Heliconid models he does not lay much stress on the conspicuous colours of these models, except in a passing reference to the pathways in the forest being quite enlivened by their bright dresses of orange, blue and yellow, and red and black. He does not emphasize this as the central point of his argument, and when he explains what he means by his term "mimetic analogies" he says "an idea of what is meant may be formed by supposing a Pigeon to exist with the general figure and plumage of a Hawk." He did not suggest that the bird which is resembled is particularly remarkable in its appearance, only that it has a certain facies of its own distinguishing it from other birds. He did not hint that the distasteful Heliconid butterflies made it easier for enemies to recognize them than other butterflies.

PLATE XI.



J. H. Cook del.

CALOSOMA INQUISITOR L. (Larva).

FIG. 21. Head and Prothorax (dorsal aspect) × 5.5.
an, antenna; lbi, labium; lbr, labrum; mn, mandible; mx, maxilla; oc, ocelli.

FIG. 22. Three Posterior Segments (dorsal aspect) × 5.5.

FIG. 23. Eleventh Segment (lateral aspect) × 9.7.
ant, anterior; post, posterior.

FIG. 24. Head (ventral aspect) × 9.7.
an, antenna; ca, cardo; g, galea; l pa, labial palp; mn, mandible; mx pa, maxillary palp; m, mentum; pm, prementum; s, stipes.

FIG. 25. Three Posterior Segments (ventral aspect) × 9.7.

FIG. 26. Leg × 9.7.
cx, coxa; f, femur; ta, tarsus; ti, tibia; tr, trochanter.

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 10, vol. xx. p. 257, *September* 1937.

A List and some Notes on the Synonymy of the Types of the Subfamily Ichneumoninæ *Ashmead* (*Hymenoptera*) *in the Collections of the British Museum and the Hope Department of the Oxford University Museum.* By GERD HEINRICH (Borowki, Poland).

DURING February 1933 I spent some time studying the types of genera of Ichneumoninæ in the collections of the British Museum and the Hope Department of the Oxford University Museum. This was necessary for the preparation of a paper on my material from Celebes, collected in 1930–32. On this occasion I made some notes on synonymy, the publication of which seems desirable. The following paper, however, must not be considered as a final result of a special examination of types of species, but only as a preliminary and incomplete communication with regard to this subject, which, no doubt, is still very far from exhausted.

I wish to tender my most hearty thanks to those who aided me in this work, especially to Sir Edward Poulton, Dr. Hugh Scott, and Mr. J. F. Perkins.

1.—ICHNEUMONINI OTHER THAN BRITISH SPECIES.

A.—A List of the Types in the General Collection of the British Museum, and in the Collections of the Hope Department of the Oxford University Museum.

In the table (pp. 258–275) is given a list of the types in these two collections with notes. Those species marked ♂ type, ♀ type, or type refer to the notes on the label of the specimens. The holotypes and lectotypes are here indicated for the first time.

Peter Cameron frequently designated more than one specimen as " type " of a species. These are now in various collections.

The species of which there are more than one " type " will at once be seen from the table. The holotypes can only be found by a careful comparison of the " types " with the original descriptions.

Name on the label of the type-specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Acanthojoppa *apicilineata* Cam.	Acanthojoppa Cam.	......	♀ type.	=A. tinctipennis Cam.
curtispina Cam.	" "	♀ type.	♂ type.	= " "
dudgeoni Cam.	" "	♀ type.		
flavoorbitalis Cam.	" "	♀ type.		
indica Cam.	" "	......	♂ type.	
lutea Cam	" "	......	♀ type.	
nigrinerva Cam.	" "	2 ♂♂ & ♀ type.	......	=A. cincticornis Cam.
nigrolineata Cam.	" "	......	♂ type.	
nigromaculata Cam.	" "	......	♀ type.	
schizoaspis Cam.*	" "	......	♀ type.	Syn. *A. xanthopsis* Cam.
tinctipennis Cam.	" "	......	♂ type.	Syn. *A. apicilineata* Cam., *A. curtispina* Cam.
tricolor Cam.	" "	♀ type.		
varicornis Cam.	" "	......	♀ type.	
xanthopsis Cam.	" "	......	♂ type.	=A. schizoaspis Cam.
Achaius flavobalteatus Cam.*	....	......	♂ type.	
Agarenes cariniscutis Cam.*	Losgna Cam.	♂ type.		
Aglaojoppa basalis Morl.	prope Melanichneumon Thoms.	♀ type.		
cæruleodecorata Cam.	Aglaojoppa Cam.	......	♀ type.	
cæruleodorsata Cam.	" "	♂ type.		
cærulescens Morl.	" "	♂ type.		
callosifer Morl.	prope Melanichneumon Thoms.	♀ type.		
cariniscutis Cam.	Aglaojoppa Cam.	♂ type.		
femorata Cam.	" "	......	♂ type.	
flavolineata Cam.	" "	♂ type.	♂ type.	
flavomaculata Cam.*	" "	♂ type.	♀ holotype.	

glabrinotor Morl.	prope Melanichneumon Thoms.	♀ type.		
iridipennis Cam.	Aglaojoppa Cam.	♀ type.		
latebalteata Cam.	„ „	......	♂ type.	
nigrocœrulea Cam.	„ „	......	♀ type.	
quadrimaculata Cam.	„ „	♂ type.	♀ holotype.	
quinquemaculata Cam.	„ „			
rothneyi Cam.	„ „	♂ type.	♀ type.	
varipes Cam.	Amblyjoppa Cam.	......	♂ type.	Torso.
violaceipennis Cam.	Aglaojoppa Cam.	......	♂ type.	
Algathia erythropoda Cam.	Melanichneumon Thoms.	......	♂ type.	
erythropoda Cam.	Algathia Cam.	......	♂ type.	Type label marked "No."
femorata Cam.	Cratichneumon Thoms.	......	♂ type.	=Cratichn. rufopetiolatus Cam.
flavobalteata Cam.	Algathia Cam.	......	♀ type.	=A. rufipes Cam.
khasiana Cam.	prope Cratichneumon Thoms.	♂ type.	♂ type.	
latebalteata Cam.	Cratichneumon Thoms.	......	♂ type.	=Cratichn. rufopetiolatus Cam.
maculifacialis Cam.	„ „	......	♂ type.	
parvimaculata Cam.	Algathia Cam.	......	♂ type.	
robusta Cam.	„ „	......	♂ type.	=A. rufipes Cam.
rufipes Cam.	„ „	......	♀ type.	Syn. *A. robusta* Cam., ♂, *A. flavobalteata* Cam., ♀.
rufopetiolata Cam.	Cratichneumon Thoms.	......	♂ type.	Syn. *A. latebalteata* Cam., *A. femorata* Cam., ♂.
tibialis Cam.	„ „	......	♂ type.	
zonata Cam.	„ „	......	♂ type.	
Amblyjoppa ælivanus Cam.	Amblyjoppa Cam.	type.	2 ♀♀ types.	Syn. *Ambl. violaceipennis* Cam., ♂
fuscipennis Cam.	Cœlichneumon Thoms.	♀ type.	......	Syn. *Protichneumon piceipennis* Morley.

Name on the label of the type-specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Amblyjoppa rufobalteata Cam.*	Amblyjoppa Cam.	♀ holotype.	♂ & ♀ types.	
ruficauda Cam.	" "	type.		
ruficeps Cam.	" "	type.		
rufocincta Cam.	Protichneumon Thoms.	......	♀ types.	
violaceipennis Cam.	Amblyjoppa Cam.	......	♂ type.	= Ambl. salivanus Cam.
Amblyteles auricomus Morl.	prope Melanichneumon Thoms.	♂ type.		
hudsoni Cam.	? non Amblyteles Wesm.	♂ type.		
ludovicus Cam.	Melanichneumon Thoms.	♀ type.		
spilogerus Morl.	prope Amblyteles Wesm.	♀ type.		
spilopterus Morl.	? non Amblyteles Wesm.	♂ type.		
Aneyra flavomaculata Cam.*	prope Hepiopelmus Wesm.	......	♂ type.	
Anisobas cincticornis Cam.	Acanthojoppa Cam.	2 ♀♀ types.	......	Syn. *Acanthojoppa nigrinerva* Cam.
Anisojoppa lutea Cam.*	?	type.	......	Torso.
Anteles rufa Cam.	Ichneumon L.	♀ type.	......	Not described.
Atanyjoppa flavomaculata Cam.	Atanyjoppa Cam.	type.		
rufomaculata Cam.	" "	......	♀ type.	
spinosa Cam.	" "	type.		
Auclandia flavolineata Cam.	Aucklandella ? Cam.	♂ type.		
flavomaculata Cam.*	" "	♀ type.		
nigromaculata Cam.	" "	♀ type.		
Aulojoppa spilocephala Cam.	Aulojoppa Cam.	♀ type.		
sulcipes Cam.	=" Trogus " gryps Morl.	♀ type.		
Barichneumon concinnator Morl.	Barichneumon Thoms.	♂ type.		
fossifer Morl.	prope Barichneumon Thomas.	♂ type.		
planinatum Morl.	Aoplus Tischb.	♀ type.		
Bathymetis testaceicornis Cam.	Phæogenine.	♀ type.		

Belargis albomaculata Cam.*	Lareiga Cam.	......	♂ type.	
Benecles dimidiatus Morl.	prope Aoplus Tischb.	♀ type.		
politanus Morl.	prope Cratichneumon Thoms.	♀ type.		
Benyllus rufus Cam.*	Benyllus Cam.	......	♀ type.	(In collection to be found among the Cryptinæ) = Ischnojoppa Kriechb.
Bodargus rufus Cam.*	Ischnojoppa Kriechb.	♀ type.	......	
Buathra rufiventris Cam.*	Cryptinæ.	......	♂ type.	
Bystra testacea Cam.*	....	......	♂ type.	
Cænojoppa longitarsis Cam.*	Cænojoppa Cam.	♀ type.		= Callajoppa lutoria F. (*Trogus lutorius* auct.).
Callajoppa *bilineata* Cam.*	Callajoppa Cam.	♀ type.	......	
Caspipina violaceipennis Cam.	....	......	♂ type.	
Catadelphus rubricaput Morl.	? non Catadelphus Wesm.	♀ type.		
stigmaticus Morl.	prope Catadelphus Wesm.	type.		
Ceratojoppa cornuta Cam.*	Ceratojoppa Cam.	♂ type.		
Charitojoppa cœrulea Cam.	Charitojoppa Cam.	♀ type.	♀ type.	Syn. *Char. varicolor* Cam.
varicolor Cam.	,, ,,	......	♀ type.	= Char. cœrulea Cam.
Chasmias ruficaudatus Morl.	?	♂ type.	......	Head missing.
Chiaglas balteatus Cam.	Chiaglas Cam.	......	♂ type.	
longicornis Cam.	,, ,,	......	♀ type.	
longiventris Cam.	,, ,,	......	♀ type.	
nigripes Cam.*	,, ,,	♂ type.	♂ type.	
tinctipennis Cam.	,, ,,			
varipes Cam.	,, ,,	♀ type.	♀ type.	
Chlorojoppa cyanea Cam.	Gœdartia Boie.	♀ type.	......	= Gœdartia Boie (Syn. *Automalus* Wesm.).
Cnemojoppa albitibialis Cam.	Protichneumon Thoms.	......	♀ type.	
flavoornata Cam.	,, ,,	......	♂ & ♀ types.	Described under the name *Amblyjoppa rufipes* Cam. (Zeitsch. Hym. u. Dipt. 1903. Heft 3, pp. 179, 180).
fuscipennis Cam.	Cœlichneumon Thoms.			
rufipes Cam.*	Cnemojoppa Cam.	......	♀ holotype.	

Name on the label of the type-specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Cnemojoppa rufipes Cam.	Cœlichneumon Thoms.	♀ type.		
Cœlichneumon apicicarinatus Morl.	non Cœlichneumon Thoms.	♂ type.		
barnstoni Morl.	Cœlichneumon Thoms.	♂ type.		
cornelliger Morl.	prope Melanichneumon Thoms.	♀ type.		
geminifer Morl.	non Cœlichneumon Thoms.	♀ type.		
globulifer Morl.	prope Cœlichneumon Thoms.	♀ type.		
properatus Morl.	Cœlichneumon Thoms.	♀ type.		
scopolifer Morl.	prope Melanichneumon Thoms.	♀ type.		
stratiatifer Morl.	Gen. nov. ?	♂ type.		
sulcifer Morl.	prope Melanichneumon Thoms.	♀ type.		
sublunifer Morl.	prope Aoplus Tischb.	♀ type.		
thyridifer Morl.	prope Cœlichneumon Thoms.	♀ type.		
viridissimus Morl.	Cœlichneumon Thoms.	♀ type.		
Colobacis forticornis Cam.*	Ichneumon L.	♀ type.		
Corymbichneumon cariniger Morl.*	Corymbichneumon Morl.	♀ type.		
Cosmiojoppa orbitalis Cam.	Hepiopelmus Wesm.	♂ type.		
ornata Cam.	prope Eupalamus Wesm.	......	♂ type.	
violaceipennis Cam.*	,, ,, ,,	......	♂ type.	
Cratichneumon coxiger Morl.	Cratichneumon Thoms.	♀ type.		
erythrogonus Cam.	Barichneumon Thoms.	2 ♂♂ types.		
havanensis Cam.	Carinodes Hank.	♂ type.		
testaceicolor Morl.	non Cratichneumon Thoms.	♂ type.		
Cratojoppa cingulata Cam.	Cratojoppa Cam.	♂ type.		
maculata Cam.	....	♀ type.		
maculiceps Cam.	....	♀ type.		
ornaticeps Cam.	....	♀ type.		
robusta Cam.*	....	♀ type.	♀ type.	

rufofemorata Cam.	....	♀ type.		
Cryptopyge pulchripennis Sm.	Cryptopyge Kriech.	type.		
Cryptus penetrator Sm.	prope Cratichneumon Thoms.	♂ type.		
Ctenochares gracilentor Morl.	....	♂ type.		
microcephalus Morl.	....	♂ type.		
Cyanojoppa *cæruleicauda* Cam.	Cœlichneumon Thoms.	......	♀ type.	=C. rufofemoratus Cam.
godwinausteni Cam.	....	......	♂ type.	
nigrocærulea Cam.	....	♀ type.	♀ type.	=C. rufofemoratus Cam.
notata Cam.	....	type.		
rufofemorata Cam.*	....	♀ type.	......	Syn. *C. cæruleicauda* Cam., *C. nigrocærulea* Cam., *C. striata* Cam.
striata Cam.	....	2 ♂♂ types.	......	=C. rufofemoratus Cam.
Darachosia fulvipes Cam.*	Heresiaches Wesm.	......	♀ type.	
Darymna zonata Cam.	?	♂ type.		
Degithina buchani Cam.*	Degithina Cam.	♀ type.		
caroli Cam.	" "	♂ type.		
davidi Cam.	" "	♂ type.		
hector Cam.	Cestocormus Cam. ?	♀ type.		
Dimætha flavinervis Cam.	Callajoppa Cam.	......	♂ type.	
nigrolineata Cam.	Facydes Cam.	......	♂ type.	
tibialis Cam.*	Dimætha Cam.	♀ type.	♀ type.	
Dinotomus basalis Morl.	Trogus Panz.	type.		
Distantella maculiscutis Cam.	Cryptine.	♂ type.		
Donipides nigrinervis Cam.	Enschisiades Cam.	......	♀ type.	
testaceinervis Cam.	" "	......	♀ type.	
Enschisiades rufipes Cam.*	" "	......	♀ type.	

Name on the label of the type specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Epijoppa cariniger Morl.	Pyramidellus Szepl.	♀ type.		
eucœlea Morl.	,, ,,	type.		
nigrocoxata Morl.	,, ,,	type.		
pygidifer Morl.	,, ,,	type.		
rubricata Morl.	,, ,,	type.		
striatifrons Morl.	,, ,,	type.		
triangulifer Morl.	,, ,,	type.		
variabilis Morl.	,, ,,	type.		
Ergatha bilineata Cam.	Heresiaches Wesm.	♂ type.	......	Identical with *Miojoppa rufa* Cam., according to Morley.
Eristicus *froggattii* Cam.	Ichneumon L.	♀ type.	......	=Fil. salomonis Cam.
iridipennis Cam.	Macrophatnus Cam.	♀ type.		
solomonis Cam.	Ichneumon L.	♀ type.	......	Syn. *E. froggattii* Cam.
Erythroischnus annulicornis Cam.	Phæogenini.	♂ type.		
Erythrojoppa ferruginea Cam.*	Erythrojoppa Cam.	♂ type.	♂ type.	Syn. *E. nigromaculata* Cam.
lineata Cam.	,, ,,	♂ type.	♂ type.	
nigripedalis Morl.	prope Erythrojoppa Cam.	♂ type.		
nigromaculata Cam.	Erythrojoppa Cam.	♀ type.	♀ type.	=E. ferruginea Cam.
rufipedalis Morl.	prope Erythrojoppa Cam.	♀ type.		
Eutanyacra pallidicoxis Cam.*	prope Amblyteles Wesm.	......	♂ type.	
stramineomaculata Cam.	,, ,, ,,	......	♂ type.	
Evirchoma pallidimaculata Cam.*	prope Benyllus Cam.	......	♀ type.	
Exephanes japonicus Cam.	non Exephanes.	♀ type.		
nigromaculata Cam.	,, ,,	♀ type.		
Fædalma tricolor Cam.*	Phæogenini.	......	♀ ? type.	

Now when Darwin was working on the application of his theory of evolution to man himself, as set out in "The Descent of Man," he was developing the theory of sexual selection and paid particular attention to the bright colours of insects which he thought might owe much to that principle.

But he got into difficulties over the case of conspicuously coloured *caterpillars*, which, being immature, could not come under the influence of sexual selection. This, I think, supports my claim that the real significance of the bright colours of Heliconidae had not been grasped, or Darwin would surely not have got into difficulties over caterpillars. Wallace supplied the explanation (27): caterpillars are so tender that an exploratory examination by an inexperienced enemy might be just as fatal as if they were eaten outright. Distastefulness alone would not protect unless it was indicated by some outward and visible sign. It would be an advantage to a caterpillar to be readily recognized and left alone to develop and reproduce its kind: if there is an advantage there is opportunity for natural selection.

Thus we arrive at the true conception of "Warning Colours." The behaviour of the green beetle, so amusingly recorded by Kirby and Spence as puffing itself out with rage, can now be seen in its real significance. The beetle is displaying an easily recognized sign that it has objectionable qualities and had better be left alone. It is not a question of trying to *alarm* the enemy, but of warning it off by an intelligible sign. But until the conception of an advantage to be gained by a conspicuous display of bright colours was arrived at, no one thought of linking together conspicuousness and distastefulness. Thus Gosse (*loc. cit.* p. 78.) writes—"Danais Archippus [*Danaus plexippus* (Linn.)], with his broad wings of orange tawny handsomely striped with black, probes the mellifluous blossoms from morning to night, and is one of the most conspicuous flutterers on the prairie." This species is now considered to be a characteristic example of warning coloration.

Note that warning colours are the antithesis of concealing colours, yet both are explained by the one theory of natural selection. Insects with the latter class of colours endeavour to conceal their edibility; the others advertize their inedibility, or some harmful quality.

Warning colours are the very foundation upon which the explanation of mimicry depends, but before the theory of natural selection was appreciated their function was misunderstood or even their presence not recognized. Thus Collingwood in 1868 (28) wrote

Fileanta *balteata* Cam.*	Fileanta Cam.	2 ♂♂ types.	♂ type.	=Fileanta cursoria Smith.
ruficauda Cam.	" "	2 ♂♂ types.	......	=Fileanta cursoria Smith.
Gathetus melanocerus Cam.*	Gathetus Cam.	♀ type.	♀ type.	
Gavrana maculipes Cam.*	prope Cratichneumon Thoms.	♂ type.		
Gurfyla albipilosa Cam.*	Barichneumon Thoms.	♂ type.	......	Syn. *S. tibialis* Cam.
tibialis Cam.	" "	♂ type.	......	=S. albipilosa Cam.
Gyrodonta flavomaculata Cam.*	Gyrodonta Cam.	......	♀ type.	
Habrojoppa leucozona Cam.	Habrojoppa Cam.	......	♂ type.	
maculifacialis Cam.	" "	......	♀ type.	
rufopetiolata Cam.	" "	......	♀ type.	
Hadrojoppa annulitarsis Cam.*	Amblyjoppa Cam.	type.		
cognatoria Cam.	" "	type.		
forticornis Cam.	" "	type.	♀ type.	
fumipennis Cam.	" "	type.	♂ type.	
maculiceps Cam.	prope Amblyjoppa Cam.	♀ type.		
Haliphera maculata Cam.*	Achaius Cam.	♂ type.		
maculipes Cam.	" "	♂ type.		
Harasces nigripes Cam.*	Barichneumon Thoms.	♂ type.		
Hiorada bilineata Cam.*	Hiorada Cam.	♂ type.	♂ type.	
Holcichneumon testaceus Cam.*	....	♀ type.		
Holcojoppa flavipennis Cam.*	Holcojoppa Cam.	......	type.	
Hoplismenus leptocerus Cam.	Cratichneumon Thoms.	type.		
micado Cam.	Callajoppa Cam.	♂ type.		
Hyptophatnus lineatus Cam.*	Hyptophatnus Cam.	♂ type.		
Ichneumon actista Cam.	....	♂ type.		
agraensis Cam.	Ischnojoppa.	......	♂ type.	
appropinquans Cam.	Myermo Cam.	......	♀ type.	
argentipilosus Cam.	Neotropichneumon Heinr.	♀ type.		
ariel Cam.	....	♂ type.		
artaxidia Cam.	Platylabus Wesm.	♀ type.		

Name on the label of the type-specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Ichneumon beatus Cam.	Cœlichneumon Thoms.	♀ type.		
bellatulus Cam.	....	♀ type.		
bilimeki Cam.	prope Melanichneumon Thoms.	♂ type.		
bivittatus Morl.	Ichneumon L.	♀ type.		
browni Cam.	Phæogenine.	♂ type.		
" "	Aoplus Tischb.	♂ type.		
budaha Cam.	Aglaojoppa Cam.	......	♂ type.	
carinifrons Cam.	Cressonianus Ashm.	♀ type.		
castor Cam.	....	♀ type.		
causticus Cam.	....	♀ type.		
celatus Cam.	....	♂ type.		
centralis Cam.	....	♀ type.		
clarimontis Cam.	prope Ichneumon L.	♂ type.		
clotho Cam.	Lareiga Cam.	......	♀ type.	
colensii Cam.	prope Cratichneumon Thoms.	♀ type.		
confuceana Cam.	Phæogenine.	......	♀ type.	
consanguinus Cam.	....	♂ type.		
conspiratus Smith	prope Cratichneumon Thoms.	♀ type.		
costaricensis Cam.	....	♂ type.		
cursorius Smith	Fileanta Cam.	♀ type.	......	Syn. *Ambl. radoszkovskii* Berth. ♀, Hein. ♂, *Fileanta balteata* Cam. ♂, *F. ruficauda* Cam.
curtituberculatus Cam.	....	♀ type.		
deceptus Smith	Degithina Cam.	♀ type.		
democraticus Cam.	....	♀ type.		
dentatus Smith	Hoplismenus Grav.	type.		

eros Cam.	....	♀ type.		
erythromelas Cam.	prope Barichneumon Thoms.	♀ type.		
exhilarator Smith	,, ,, ,,	♂ type.		
falsus Cam.	,, ,, ,,	♂ type.		
fastidiosissimus Cam.	....	♂ type.		
flavitarsis Smith.	Cœlichneumon Thoms.	type.		
forreri Cam.	....	♂ type.		
frederici Cam.	prope Cœlichneumon Cam.	♀ type.		
generosus Smith.	Ichneumon L.	♂ type.		
godwinausteni Cam.	Cœlichneumon Thoms.	type.	......	Torso.
guatemalensis Cam.	....	♀ type.		
helmsi Cam.	Ichneumon L.	♂ lectotype.		
,, ,,	Phæogenine.	♂ type.		
hersilia Cam.	....	♂ type.		
huttoni Kirby	....	type.		
hypocrita Cam.	Cryptine.	......	♂ type.	
impudicus Cam.	....	♂ type.		
incanescens Smith	Tricholabus Thoms.	♀ type.	......	Syn. *Otohimea nigra* Uchida.
inquieta Cam.	Phæogenine.	......	♀ type.	
insidiator Smith	Ichenumon L.	♂ type.		
insolitus Cam.	Cratichneumon Thoms.	♂ type.		
intammatus Cam.	Cryptine.	......	♂ type.	
intequata Cam.	Ichneumon L.	......	♂ type.	
invectus Smith	prope Degethina Cam.	♀ type.		
irritator Smith	Melanichneumon Thoms.	♀ type.		
ixia Cam.	prope Cratichneumon Thoms.	♀ type.		
jalapensis Cam.	Melanichneumon Thoms.	♂ type.		
johanni Cam.	,, ,,	♀ type.		
jukatenensis Cam.	....	♀ type.		
lariceus Cam.	....	type.		
leodacus Cam.	non Ichneumon L.	♀ type.		

Name on the label of the type-specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Ichneumon lepidus Cam.	prope Ichneumon.	♂ type.		
lissoscapus Cam.	Cratichneumon Thoms.	♀ type.		
maclanus Cam.	prope Cratichneumon Thoms.	♀ type.		
maculipleuralis Cam.	Ichneumon L.	♀ type.		
mathewi Cam.	Stenichneumon Schrank.	♂ type.		
motivus Cam.	....	type.		
natalensis Cam.	prope Melanichneumon Thoms.	♂ type.		
notabilis Cam.	Matara Holmgr.	♂ type.		
numerica Cam.	prope Ichneumon L.	type.	♂ type.	
opionosus Cam.	....	♂ type.		
opiparus Cam.	....	♀ type.		
oppilatus Cam.	....	♂ type.		
orizabensis Cam.	....	♀ type.		
pacificus Cam.	prope Amblyteles Wesm.	♀ type.		
parsimonicus Cam.	....	♂ type.		
pascoei Kirby	Ichneumon L.	type.		
patricius Hal.	Triptognathus Berth.	♀ type.		
perfidiosus Smith	prope Œgethima Cam.	♀ type.		
peringueyi Cam.	Phæogenine.	♀ type.		
phædra Cam.	prope Œgethima Cam.	♂ type.		
placidus Smith	prope Cratichneumon Thoms.	♀ type.		
platyaspis Cam.	Ichneumon L.	♀ type.		
plebejus Hal.	prope Ichneumon L.	♂ type.		
pollux Cam.	....	♂ type.		
prosymna Cam.	prope Melanichneumon Thoms.	♀ type.		
pterelas Cam.	....	♀ type.		
pyrastus Cam.	....	♂ type.		

questor Cam.	prope Carinodes Hank.	♀ type.		
richardi Cam.	prope Cratichneumon Thoms.	♂ type.		
rothneyi Cam.	Melanichneumon Thoms.	type.	♀ type.	
rubrocinctus Cam.	Macrophatnus Cam.	♂ type.		
sallæi Cam.	,, ,,	♂ type.		
semiobscurus Cam.	,, ,,	♂ type.		
sublutus Cam.	,, ,,	♂ type.		
subpinguis Cam.	,, ,,	♀ type.		
subseciva Cam.	,, ,,	♂ type.		
suffragenia Cam.	,, ,,	♂ type.		
suffultus Cam.	,, ,,	♂ type.		
sycophantus Cam.	,, ,,	♂ type.		
tapiobanæ Cam.	,, ,,	......	♀ type.	
thulensis Ruthe	Ichneumon L.	♀ type.		
thyelma Cam.	Phæogenine.	♂ type.		
transvalensis Cam.	prope Melanichneumon Thoms.	♀ type.		
trunculentus Cam.	,, ,, ,,	type.		
tumidulus Cam.	,, ,, ,,	♀ type.		
turpiculus Cam.	,, ,, ,,	♂ type.		
ursula Cam.	,, ,, ,,	♀ type.		
utetes Cam.	Phæogenine.	♀ type.		
vacillans Cam.	prope Exetastes.	......	♂ type.	
valladolensis Cam.	,, ,,	♂ type.		
veo Cheesm.	Ichneumon L.	♀ type.		
veræpacis Cam.	,, ,,	♀ type.		
vexator Smith.	Melanichneumon Thoms.	♀ type.		
virulentus Smith	,, ,,	♀ type.		
vischnu Cam.	Barichneumon Thoms.	......	♂ type.	
wellingtoni Cam.	non Ichneumon L.	♀ type.		
xanthorrhœus Hal.	Phygadeuonine.	♂ type.		
Ileanta cariniscutis Cam.	Ileanta Cam.	♀ type.	♀ type.	
fulvipes Cam.	,, ,,	......	♀ type.	

Name on the label of the type-specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Ileanta latitarsis Cam.*	Ileanta Cam.	......	♀ type.	
trochanterata Cam.	,, ,,	......	♀ type.	
Imeria magretti Cam.	Imeria Cam.	......		
Ischnojoppa luteator, var.	....	type.		
unicolor Morl.	non Ischnojoppa Kriech.	♂ type.		
salvini Cam.	,, ,, ,,	♀ type.		
Joppa bimaculata Cam.	Joppa Fab.	type.		
chiriquensis Cam.	,, ,,	type.		
dentipes Cam.	,, ,,	type.		
distinguens Morl.	,, ,,	type.		
elegans ? Smith ?	Macrojoppa Kriech.	type.		
flavinervis Cam.	Joppa Fab.	type.		
geniculata Cam.	,, ,,	type.		
hilaris Smith	,, ,,	type.		
maculicornis Cam.	,, ,,	type.		
melanostigma Cam.	,, ,,	type.		
modesta Smith	,, ,,	type.		
nigriceps Cam.	,, ,,	type.		
rogersi Cam.	,, ,,	type.		
stigmatica Morl.	,, ,,	type.		
varimaculata Cam.	,, ,,	type.		
variolosa Smith	,, ,,	type.		
varipes Cam.	,, ,,	type.		
xanthostoma Cam.	,, ,,	type.		
Joppites bivittata Morl.	non Joppites.	♀ type.		
madecassa Morl.	Stenophorus Sauss.	♀ type.		
Lachmetha spinitarsis Cam.*	Lachmetha Cam.	......	2 ♀ types.	

Lagenesta duplicator Morl.	non Lagenesta Cam.	♀ type.		
ferruginea Cam.*	Eupalamus Wesm.	♀ type.	♀ type.	
„ „	„ „	♂ type.		
monitor Morl.	non Lagenesta Cam.	♂ type.		
sinifer Morl.	„ „ „	♀ type.		
triplicator Morl.	„ „ „	♀ type.		
violaceipennis Cam.	Eupalamus Wesm.	♀ type.		
Lamprojoppa cœrulea Cam.*	prope Platylabus Wesm.	......	♀ type.	
fuscinerva Cam.	„ „ „	......	♀ type.	
Lareiga *albomaculata* Cam.	Cratichneumon Thom.	♀ type.	......	=Cratichn. cameroni Heinr.
flavomaculata Cam.	„ „	♂ type.		
rufofemorata Cam.*	„ „	♀ holotype.	♀ type.	=Cratichneumon cameroni Heinr. (Syn. Lareiga albomaculata Cam.).
„ „	„ „	♂ type.		
Lausoba forticeps Cam.*	Lausaba Cam.	♂ type.	......	Syn. Genus *Œdicephalopsis* Heinr. (Mitt. Zool. Mus. Berlin, 1930, xv. p. 548).
Legnatia fulvipes Cam.*	Legnatia Cam.	......	♀ type.	
Leptojoppa erythrothorax Cam.*	Leptojoppa Cam.	♀ type.	♀ type.	
Leptophatnus ornatiscutis Cam.	non Leptophatnus.	♂ type.		
Leptothecus alutacefer Morl.	non Leptothecus Cam.	♀ type.		
mesonotifer Morl.	prope Leptothecus Cam.	♀ type.		
punctifer Morl.	Cryptine.	♂ type.		
rufomaculatus Cam.*	Leptothecus Cam.	♀ type.		
Lereyna ferruginea Cam.	Ichneumon L.	♀ type.	......	Apparently undescribed.
Lindigia africana Morl.	Liojoppa Szepl.	type.		

Name on the label of the type-specimens. (Species marked with an asterisk are genotypes.)	Genus to which the species should be assigned.	Material in the British Museum.	Material in the Hope Department.	Notes.
Lindigia immaculata Morl.	prope Melanichneumon Thoms.	type.		
multiplagiata Cam.	....	type.		
ochracea Morl.	non Lindigia Szepl.	type.		
Linteria maculata Cam.	prope Cratichneumon Thoms.	♂ type.		
ornaticeps Cam.	” ” ”	♂ type.		
violaceipennis Cam.*	” ” ”	♂ type.		
Lissichneumon lævis Cam.	Cratichneumon Thoms.	♂ type.		
Lortygia rufa Cam.*	prope Melanichneumon Thoms.	......	♂ type.	
Losgna forticeps Cam.*	Losgna Cam.	......	♀ type.	
Macrojoppa conflatus Morl.	Macrojoppa Kriech.	type.		
imperialis Morl.	” ”	type.		
parviceps Cam.	Aræoscleis Schulz.	type.		
Macrophatnus balteatus Cam.	Macrophatnus Cam.	♂ type.		
rufipes Cam.*	” ”	♂ type.		
trilineatus Cam.	” ”	♂ type.		
Magrettia crassispina Cam.	Xenojoppa Cam.	♂ type.	♀ type.	} =Xenojoppa crassispina Cam.
maculiceps Cam.	” ”	......	♂ type.	
Maraces flavobalteatus Cam.*	Maraces Cam.	♀ type.		
pectinalis Cam.	” ”	......	♀ type.	
Melanichneumon carinifer Morl.	prope Melanichneumon Thoms.	♀ type.		
jukaii Cam.	prope Togea Uch.	♀ type.		
glaucopterus Morl.	prope Melanichneumon Thoms.	♂ type.		
leptothecus Cam.	prope Cœlichneumon Thoms.	♀ type.		
melanoptera Morl.	non Melanichneumon Thoms.	♀ type.		
muciallæ Wilk.	prope Melanichneumon Thoms.	♀ type.		
Miojoppa ornaticeps Cam.	prope Cratichneumon Thoms.	♂ type.		
Myermo fumipennis Cam.	Myermo Cam.	♂ type.	♂ type.	

iridipennis Cam.	prope Melanichneumon Thoms.	♂ type.		
maculitarsis Cam.	Stenichneumon Schrank.	♀ type.	♀ type.	
rufipes Cam.*	Myermo Cam.	♂ type.	♀ holotype.	
Nænaria grandiceps Cam.*	Nænaria Cam.	......	♀ type.	
Neotypus obscurator Morl.	Rhadinodonta Szepl.	♂ type.		
Nirvana maculipennis Morl.*	Magwenga Morl.	♀ type.	......	Described as Magwenga maculipennis Morl.
Odontojoppa metallica Cam.*	prope Cratichneumon Thoms.	♂ type.	♂ type.	
Œdicephalus erythropygus Morl.	Œdicephalus Cress.	type.		
fortispina Cam.	" "	type.		
glucudatus Cam.	" "	type.		
lineiger Morl.	" "	type.		
Orizabia latepetiolata Cam.*	Abzaria Cam.	♂ type.	......	Described as Abzaria lateopetiolata Cam. B.C.A.
Oxyjoppa flavobalteata Cam.*	Pyramidellus Szepl.	type.		
Pachyjoppa tibialis Cam.*	Pachyjoppa Cam.	......	♀ type.	
Patroclus venezuelensis Cam.	....	♂ type.		
Pedinopelte violaceipennis Cam.	....	type.		
Phaisura nigriceps Cam.*	Phaisura Cam.	♂ type.		
Phygadeuon prælatus Hal.	? Ctenichneumon Thoms.	type.		
Platylabus altitudinis Turn.	Platylabus Wesm.	type.		
atricinctus Morl.	non Platylabus Wesm.	♂ type.		
mediorufus Morl.	" " "	♀ type.		
rufoornatus ?	Melanichneumon Thoms.	♀ type.		
Pramha mandibularis Cam.*	Pramha Cam.	......	♀ type.	
Probolus albocinctus Cam.	Ichneumon L.	♀ type.		
varilineata Cam.	" "	♂ type.		
Protichneumon persicus Morl.	Protichneumon Thoms.	♀ type.		
Pseudamblyteles ormsbyensis Cam.	Ichneumon L.	♂ type.		
Setanta femoralis Cam.	Setanta Cam.	......	♀ type.	

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Setanta rufipes Cam.*	Setanta Cam.	......	♀ type.	
Spilichneumon didymatus Morl.	prope Melanichneumon Thoms.	♂ type.		
triangulator Morl.	Macrophatnus Cam.	♂ type.		
unipunctor Morl.	prope Macrophatnus Cam.	♂ type.		
Stenichneumon castanopygus Morl.	non Stenichneumon Thoms.	♂ type.		
ochraceator Morl.	„ „ „	type.	......	Torso.
watertoni Morl.	Neotropichneumon Heinr.	♂ type.		
Stirexephanes melanarius Cam.*	Stirexephanes Cam.	♀ type.		
Stirojoppa violaceipennis Cam.*	Stirojoppa Cam.	type.		
Sutida rufipes Cam.	Heresiarches Wesm.	♀ type.	......	Apparently undescribed.
Sycaonia rufofacies Cam.*	Cratichneumon Thoms.	......	♀ type.	
Tetragonochora abdominalis Morl.	....	type.		
anomala Morl.	....	type.		
balteata Cam.	....	type.		
maculicollis Cam.	....	type.		
rufa Cam.	....	type.		
solabilis Cam. (" Cryptus ")	....	type.	......	*cf.* Morley, Rev. Ichn. iv. 73.
tarsalis Morl.	....	type.		
theronioides Morl.	....	type.		
Trogomorpha godmani Cam.	....	type.		
lymphatus Cam.	....	type.		
melanopoda Cam.	....	type.		
panamensis Cam.	....	type.		
Trogus arrogans Smith	Callajoppa Cam.	type.		
chinensis Morl.	Amblyjoppa Cam.	type.		

"Amongst the bushes immense Orthopterous insects (Grylli) flew about, exhibiting a deep red underwing and looking very much like small birds."

Let me quote to you an observation of my own which illustrates the actual value of such coloured hindwings in saving the bearer's life. A common African grasshopper (*Phymateus viridipes* Stål.) is a large, conspicuous, bluish-green and red insect which flies heavily showing purple wings. I watched a fowl, in camp in Uganda, run eagerly up to one of these grasshoppers which was sitting quietly on the ground, its purple hindwings closed under the green wing-covers. The insect remained apparently unconcerned until the fowl drew near, when it raised the wing-covers and wings vertically, spreading out the latter to show the brilliant tints. The fowl halted, gazed at the grasshopper, turned round and walked away. Another day a specimen was killed and laid on the ground, the coloured wings of course being concealed. Fowls pecked at it but obviously found it very tough, and, though they pulled it about, ate none of it (29). It may be said that the fowl in Africa eats as many grasshoppers (of edible kinds) as it can catch.

The Darwinian theory alone can explain such an observation as this.

In mimicry we find the same conspicuousness, but it is based on bluff; there is no distastefulness to back it up. It cannot, therefore, be universally adopted as a means of defence, for a bluff to succeed must be only occasional; if perpetual it is soon found out. Poulton (30) to whom the study of mimicry is so heavily indebted, devised a term for this kind of resemblance which is much more accurate than the phrase "Mimicry" with its implication of a deliberate conscious assumption by one individual of a characteristic peculiar to another. This term, *Pseudaposematic*, signifying the possession of *false* warning colours, is found rather difficult by the non-technical mind, and I fear will never replace wholly the misleading "Mimicry." Moreover the use of the term mimicry for the likeness of one insect to another covers two completely different types of resemblance of which Pseudaposematic coloration (as described by Bates, and there fore often called Batesian mimicry) is one.

The other type was first noted by the great German naturalist Fritz Müller in 1879, some 17 years after Bates (31). He showed that the very butterflies which Bates had described as subjects for mimicry by less distasteful forms often resembled each other to an even greater degree than they were resembled by the defenceless

excellens Cam.	Trogus Panz.	type.		
gryps Morl.	Pepsijoppa Heinr.	♀ type.		
flammipennis Morl.	Callajoppa Cam.	type.		
montanus Cam.	Anisobas Wesm.	type.		
pepsoides Smith.	Callajoppa Cam.	type.		
Tyanites rufipes Cam.*	Ichneumon L.	♀ type.		
Ulestra varicornis Cam.*	Ulestra Cam.	......	♀ type.	
Vabsaris forticornis Cam.*	Cratichneumon Thoms.	♂ type.		
Xanthojoppa areolator Morl.	....	♂ type.		
bipappilator Morl.	prope Macrophatnus Cam.	♂ type.		
collifer Morl.	....	♀ type.		
cothurnatus Morl.	....	♂ type.		
crassispina Cam.	Acanthojoppa Cam.	♂ type.	♀ type.	
debilator Morl.	....	♂ type.		
explanator Morl.	....	♂ type.		
femorata Cam.	Euplamus Wesm.	......	♂ type.	Syn. *X. geniculata* Cam.
geniculata Cam.	,, ,,	......	♀ type.	=Eupalamus femoratus Cam.
gracilator Morl.	....	♂ type.		
nigrolineata Cam.*	prope Xestojoppa Cam.	......	♂ type.	
striator Morl.	....	♂ type.		
trilineata Cam.	Hoplismenus Grav.	♀ lectotype.	♀ type.	
truncator Morl.	Stenophorus Sauss.	♀ type.		
Xenojoppa *crassispina* Cam.*	Xenojoppa Cam.	♀ type.	......	Syn. *Magrettia maculiceps* Cam.
ettchelsii Cam.	,, ,,	♀ type.		
fossifrons Morl.	non Xenojoppa.	♀ type.		
Xestojoppa *bilineata* Cam.	Xestojoppa Cam.	......	♀ type.	=X. olivacea Cam.
olivacea Cam.*	,, ,,	♀ type.	♀ type.	Syn. *X. bilineata* Cam.
Zestocormus malanopus Cam.*	Zestocormus Cam.	♀ type.		
Zonojoppa violaceipennis Cam.*	Atanyjoppa Cam.	♀ holotype.		
violaceipennis Cam.	,, ,,	♂ type.		

B.—Notes on the Synonymy of Species and on the Genera to which they should be assigned.

Acanthojoppa apicilineata Cam., ♀=*Acanthojoppa curtispina* Cam., ♂.
=*Acanthojoppa tinctipennis* Cam., ♂.

All three species were described in 1903 from the Khasia Hills.

Acanthojoppa schizoaspis Cam., ♀=*Acanthojoppa xanthopsis* Cam., ♂, Khasia Hills.

Acanthojoppa ("*Anisobas*") *cincticornis* Cam., ♀ (1902) =*Acanthojoppa nigrinerva* Cam., ♂♀ (1909), Borneo.

Algathia rufipes Cam., ♀=*Algathia robusta* Cam., ♂.
=*Algathia flavobalteata* Cam., ♀.

All three species were described in 1904 from the Khasia Hills. They represent both sexes or unimportant individual variations in colour.

Algathia rufopetiolata Cam., ♂=*Algathia latebalteata* Cam., ♂.
=*Algathia femorata* Cam., ♂.

The three species, also described in 1904 from the Khasia Hills, represent very unimportant individual colour-variations.

Amblyjoppa ælivanus Cam., ♀ (1897)=*Amblyjoppa violaceipennis* Cam., ♂ (1903), Khasia Hills.

Amblyjoppa fuscipennis Cam., ♀=*Cœlichneumon fuscipennis* Cam., ♀.
Syn. *Protichneumon piceipennis* Morl.

Morley has synonymized the genus *Amblyjoppa* Cam. with *Protichneumon* Thoms., and because in the latter the name of the species "*fuscipennis*" was preoccupied, he substituted for it the name *piceipennis* Morl. The type of "*Amblyjoppa fuscipennis* Cam.," however, belongs neither to *Amblyjoppa* Cam. nor to *Protichneumon* Thoms., but to *Cœlichneumon* Thoms., and so the species may retain the first name.

Anisobas cincticornis Cam. vide *Acanthojoppa cincticornis* Cam.

Bodargus rufus Cam., ♀=*Ischnojoppa luteator* F.
Syn. *Ichneumon agraensis* Cam., ♂.

Charitojoppa cœrulea Cam., ♀=*Charitojoppa varicolor* Cam., ♀, Khasia Hills.

The type of *Charitojoppa varicolor* Cam. seems to me not to be a variation, but an anomalous, perhaps chemical transformation in colour.

Cnemojoppa rufipes Cam., ♀, MS. name (1907, Tijd. Schr. Ent. l. p. 77). This species was described under the name *Amblyjoppa rufipes* Cam., but it differs so much from the typical species of the genus *Amblyjoppa* Cam., and also from *Protichneumon* Thoms., that the erection of a new genus seems to be justified. As Cameron has only once mentioned his genus "*Cnemojoppa*," without description, I now give one.

Genus *Cnemojoppa* Cam. Comes nearer to *Protichneumon* Thoms. than to *Amblyjoppa* Cam. Abdomen of the female oxypygidial, postpetiole striate. Differs from *Protichneumon* Thoms. by the very long and slender abdomen with parallel sides, the larger gastrocœli with a narrow space between them, and the more sharply prominent area superomedia.

Type: *Cnemojoppa rufipes* Cam. in coll. Rothney, Oxford, Hope Dept., described as *Amblyjoppa rufipes* (Zeitschr. Hym. und Dipt. 1903, Heft 3, pp. 179–180).

Cyanojoppa rufofemorata Cam., ♀=*Cœlichneumon rufofemoratus* Cam., ♀
Syn. *Cyanojoppa nigrocœrulea* Cam., ♀.
Syn. *Cyanojoppa cœruleicauda* Cam., ♂.
Syn. *Cyanojoppa striata* Cam., ♂.

All these types represent only individual and unimportant colour-differences of the same species.

Erythrojoppa ferruginea Cam., ♂=*Erythrojoppa nigromaculata* Cam., ♀, Khasia Hills.

These types represent the sexes of a species. *Erythro-*

joppa lineata Cam., ♂, is perhaps only a melanic of the male.

Eristicus solomonis Cam., ♂ = *Ichneumon solomonis* Cam.
Syn. *Eristicus froggattii* Cam., ♀.

Ichneumon cursorius Smith, ♀ = *Fileanta cursoria* Smith.
Syn. *Amblyteles radoszkowskii* Berth., ♀.
Syn. *Fileanta balteata* Cam., ♂.
Syn. *Fileanta ruficauda* Cam., ♂.
Syn. *Triptognathus radoszkowskii* Heinr., ♂.

This species seems to be common in all Asiatic mountains with dry climate. On account of the undidentate mandibles I placed it in the genus *Triptognathus* Berth. But it differs from it by the much more slende· and longer antennæ and legs of both sexes, and by the hypopygium of the male being not very acute, and the convex scutellum of the male. So the erection of the genus *Fileanta* Cam. now seems to me to be justified.

Ichneumon incanescens Cam. = *Tricholabus incanescens* Cam., Japan.
Syn. *Otohimea nigra* Uch.

Ichneumon insolitus Walker = *Cratichneumon insolitus* Walker, Japan.

The type bears a label from Morley "= *Cratichneumon annulator* F.," but it is not identical with this specie:.

Fileanta balteata Cam. vide *Ichneumon cursorius* Smith.

Gurfyia albipilosa Cam. = *Gurfyia tibialis* Cam., Simla.

Both types represent only unimportant individual differences of the same species.

Lareiga rufofemorata Cam. = *Cratichneumon cameroni* Heinr.
Syn. *Lareiga albomaculata* Cam.

Neotypus obscurator Morley, ♂ (1919) = *Rhadinodonta obscurator* Morl.

The type agrees only in colour with *Neotypus* Först. It belongs to the genus *Rhadinodonta* Szepl., described in 1910 from the Kilimanjaro, and is perhaps also conspecific.

Xanthojoppa femorata Cam., ♂=*Eupalamus femoratus* Cam., ♂.
Syn. *Xanthojoppa geniculata* Cam., ♀.

The two types represent the sexes of the same species, which belongs to the genus *Lagenesta* Cam., a synonym of *Eupalamus* Wesm.

Xenojoppa crassispina Cam., ♀=*Magrettia maculiceps* Cam., ♂, Khasia Hills.

Xestojoppa bilineata Cam., ♀=*Xestojoppa olivacea* Cam., ♀.

The two types represent unimportant colour-differences.

Myermo rufipes Cam., ♂♀=*Myermo fumipennis* Cam., ♂.

Magrettia maculiceps Cam., ♂, vide *Xenojoppa crassispina* Cam.

2.—British Ichneumoninæ.

Ichneumon crassorius Desv. ♂♀=*Ichneumon didymus* Grav.

Morley has erroneously synonymised in his 'British Ichneumons' this species with *Ichneumon inquinatus* Wesm.

Ichneumon paludator Desv., ♀=*Chasmias paludicola* Wesm.

Morley placed this species in *Ichneumon quæsitorius* Grav., but the latter is not represented in the British Ichneumoninæ.

Amblyteles flavocinctus Desv., ♂=*Amblyteles panzeri* Wesm.

Ichneumon semirufus Desv., ♀=*Ichneumon apricus* Grav.

In the 'British Ichneumons' Morley has put this species in the genus *Platylabus*, but he remarks : "... it is quite possibly known on the Continent under a different name ...."

Ichneumon rufipes Steph. ♀; belongs neither to *Eurylabus* Wesm., where Morley placed it, nor at all to the subfamily *Ichneumoninæ* Ashm.

THE ETHIOPIAN SPECIES OF THE *FASCIATA* GROUP OF THE GENUS *BACTRIA* (= *PROMACHUS*) (DIPTERA, ASILIDAE).

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CONTENTS.

I. FOREWORD.

In the course of my researches on the feeding habits of predacious insects it was my privilege to study the collection of Asilidae and prey made by Dr. S. A. Neave in Nyasaland during the years 1912, 1913 and 1914, and presented to the British Museum (Natural History) by the Imperial Institute of Entomology in 1921. This series, comprising some 2,600 specimens, is probably the largest collection of Asilidae and their prey ever made in one district, and much credit is due to Dr. Neave for his skill and patience in making so many important bionomic observations in such a comparatively short time.

In the early stages of my work on the Neave collection considerable difficulty was experienced in the determination of species of the *fasciata* group of the genus *Bactria* (=*Promachus*). Similar difficulties had evidently been encountered by others, for at the beginning of the investigation the whole of the material in the general collection of the British Museum (Nat. Hist.) stood under three names (*Promachus robertii* Macq., *P. fasciatus* F., and *P. xanthotrichus* Bezzi), although many more species were involved. The present paper is an attempt to facilitate identification within the group, and was undertaken in order that Dr. Neave's bionomic observations might be recorded.

II. GENERIC NOMENCLATURE.

At the end of Meigen's original description of *Asilus pictus* (1820, 'Syst. Beschreib. Europ. Zweifl. Insekt.,' Aachen, **2**: 307,

2, Pl. 21, Figs. 6 and 8) occur the words 'Aus Ungarn; Herr Megerle von Mühlfeld schikte [*sic*] sie unter dem Namen *Bactria rufipes*.' In publishing Megerle's manuscript name Meigen gave it a status in nomenclature under Opinion 4 of the International Rules (*Cf.* E. Csiki, 1929, 'Xe Congrès International de Zoologie', Budapest, **2**: 1598) which states that 'Manuscript names acquire standing in nomenclature when printed in connection with the provisions of Art. 25, and the question as to their validity is not influenced by the fact whether such names are accepted or rejected by the author responsible for their publication'. Article 25 merely defines the law of priority and requires (prior to 1931), *a*, that the name be accompanied by an indication, or a definition, or a description, and *b*, that the author has applied the principles of binary nomenclature — requirements with which Meigen's work complies. Since the description of *rufipes* may be considered to include the description of the genus *Bactria,* the latter name is again valid under Opinion 43.

The name *rufipes* falls as a synonym of *pictus*, which has page priority, but under Opinion 4 the earlier name *Bactria* Meigen, 1820, must be substituted for the genus usually known as *Promachus* Loew, 1848. This synonymy was known to Kertész (1909, 'Cat. Dipt.', Budapest, **4**: 216) although the name was not adopted. A year later D. W. Coquillet (1910, 'The type-species of the North American genera of Diptera', *Proc. U.S. Nat. Mus.*, **37**: 499-647) accepted the older name, but subsequent authors have erroneously failed to follow him. It is quite evident from Loew's remarks (1848, *Linn. Ent.*, **3**: 392) that the name *Promachus* would never have been proposed if he had not been mistaken in believing that *Bactria* had been used elsewhere as a generic name. The complete synonymy is given below.

1820. *Bactria* Meigen, 'Syst. Beschr. Zweifl. Ins.', Aachen, **2**: 307-308, Pl. 21, Figs. 6 and 8.
GENOTYPE: *Asilus pictus* Meigen as *Bactria rufipes* (Mergerle MS.) Meigen by monotypy.

1838. *Trupanea* Macquart, 'Dipt. Exot.', Paris, **1** (2): 91.
GENOTYPE: *Asilus maculatus* Fabricius by original designation. [Preoccupied in Diptera by F. v. P. Schrank, 1795, 'Briefe Donaumoor', Mannheim: 147.]

1848. *Promachus* Loew, *Linn. Ent.*, **3**: 390.
GENOTYPE: *Asilus maculatus* Fabricius by subsequent designation of D. W. Coquillet, 1910, *Proc. U.S. Nat. Mus.*, **37**: 595.

1887. *Philomachus* Karsch, *Berlin. Ent. Zeitschr.*, **31**: 375.
GENOTYPE: *Asilus vagator* Wiedemann as *Philomachus rhopalocerus* Karsch by monotypy. [Preoccupied in birds by P. H. G. Moehring,

1758, 'Geschach. Vogel.' (Nozem. and Vosm. ed.) Amsterdam: 7 and 66.]

1925. *Trypanoides* Becker, *Ent. Mitt.*, **14**: 71.
GENOTYPE: *Trupanea testaceipes* Macquart by subsequent designation of E. O. Engel, 'Asilidae,' in E. Lindner, 1926, 'Die Fliegen der Palaearktischen Region,' Stuttgart, **24**: 22.

1930. *Enagaedium* Engel, *Konowia*, **8**: 459.
GENOTYPE: *Asilus Pœtinus* Walker by monotypy.

III. THE GENUS *BACTRIA* MEIGEN: DEFINITION AND SUBGENERA.

DEFINITION:

BACTRIA: As Asiline genus comprising robust, more or less hairy species. Antennae at their base widely separated from one another; style bare, apex pointed or dilated. Scutellum with hairs and bristles; metanotum bare. Claws sharply pointed. Wings with three submarginal cells (*i.e.* cell R_4 and two cells, 1st R_3 and 2nd R_3, formed by a recurrent vein which arises from vein R_4 and extends backwards to meet vein R_{2+3}); fork-point of vein R_{4+5} at or beyond the middle of cell R_5; vein R_1 bent so that cell 2nd R_3 is slightly constricted (somewhat as in a sole at the instep); vein R_5 reaching the costa beyond the apex of the wing; cell R_5 open. Abdomen moderately elongate, conical, not broad nor dorso-ventrally compressed; ovipositor without spines, short (formed by the last three segments) or long (formed by the last five segments); male terminalia stout or slender, with or without a tuft of snow-white hairs.

SUBGENERA: Dr. E. O. Engel, following an arrangement by the late Prof. F. Hermann, was the first to publish a subdivision of the so-called genus *Promachus* into subgenera (*Cf.* 1929 (1930), *Konowia*, **8** (4): 458, and 1932, *Ann. Transv. Mus.*, **14** (4): 251-2). In these two papers the genera *Philomachus* and *Trypanoides* were treated as subgenera of the comprehensive genus *Promachus*, the subgenus *Promachus sens. str.* was retained and a new subgenus *Enagaedium* was erected. Of the names given in the previous section of the present paper, *Trupanea* is a synonym of *Promachus sens. str.*, both having the same genotype. The genotype *picta* Meig. of the genus *Bactria* is described and figured as having the antennal style dilated at the apex, and is, therefore, congeneric with *Philomachus*, having *vagator* Wied. (=*rhopalocerus* Karsch) as the genotype. The name *Bactria* has priority over all the names within the group, and hence the comprehensive genus *Promachus* should now be known as *Bactria*, and may be divided into four subgenera, *viz.*—*Bactria*, *Promachus*, *Trypanoides* and *Enagaedium*. A key to these subgenera is given below:—

1\. Apex of antennal style dilated .... *Bactria* Meig. *sens. str.*
—. Apex of antennal style pointed .... 2.
2\. Ovipositor short, the two halves of the tenth tergite with the distal extremities pointed and diverging .... *Enagaedium* Engel.
—. Ovipositor short or long, the two halves of the tenth tergite sub-ovate and not diverging .... 3.
3\. Ovipositor of medium size, formed by the last three segments .... *Promachus* Loew.
—. Ovipositor very long, formed by the last five segments *Trypanoides* Beck

IV. The *Fasciata* Group: Definition, Distribution and Discussion.

The subgenus *Promachus* includes a number of closely allied species having conspicuous tufts of white or yellow hairs on the first three abdominal segments. These form a natural and easily recognised group, conveniently known as 'the *fasciata* group' from the name of the oldest described species. The group is widely distributed, species having been described from South America, the East Indies and Africa. The present paper treats of Ethiopian species only; nine such species have been previously described; to these twenty-one new species are now added.

The numerous species of the group closely resemble one another, and the superficial characters to which most early descriptions are limited are rarely sufficient for the determination of species. The present paper is based upon an examination of the terminalia, the most distinctive structural differences occurring in the aedeagus,[1] of which figures are given for all species known to me. Although superficial colour differences are included in the following descriptions, great care must be exercised in their use until more material has been studied and the range of variation fully understood; at the present time determinations should always entail reference to the aedeagus. Other structural differences to be noted in the males include modifications in the shape of the ninth tergite, and of the eighth and ninth sternites of the abdomen; the form of the posterior legs, the arrangement of spines which they bear, and the relative width of the eye as compared with that of the face. The relative lengths of the antennal segments, which are so freely used in modern descriptions of Asilidae, are of little value in this group, as they show too much variation. Much time and care has been expended in the search for other valid structural

[1] An excellent account of the morphology of the aedeagus is given by H Reichardt (1020, 'Untersuchungen über den Genitalapparat der Asiliden,' *Z wiss. Zool*, 185: 257-301), but systematists on the Asilidae make scarcely any reference to this organ. Within the *fasciata* group the aedeagus is exceedingly constant in shape for any one species, shows considerable differences in form in the various species, is easily figured, and may usually be recognised without dissection. Dipterists would be well advised to test its value in other groups of Asilidae.

mimics. Here was a phenomenon which could only be explained by natural selection.

Müller pointed out that no young animal is born with instinctive knowledge of what is good to eat: each has to learn for itself. This process of learning involves experimental tasting which means death to a certain number of species under examination until the youngster has learnt, and remembers, what it looks like. Any species which has impressed itself on his memory as nasty or harmful will thus be avoided after the lesson has been learnt. Experimental tasting is the agency by which natural selection has brought about warning colours, which assist the young to recognize distasteful species with the minimal amount of loss to the latter.

Let us suppose that this loss to a certain species, A, represents 10% of its number, and that another species of different appearance, Z, similarly loses 10%. Now if, owing to the natural variability of Z, it produced one day a form Z^1 which could be, even momentarily, mistaken for A, it might escape an enemy and live to perpetuate its peculiarities in some at least of its offspring, and would therefore have an advantage over the usual form Z, unlike A. You can imagine the process of gradual perfection of the likeness of Z^1 to A until the two together share one pattern and colour. This pattern still continues to lose 10%, but note that this loss is now shared by two different types, A and Z^1, each of which loses only a proportion. For simplicity let us suppose that each loses half. We have then Z^1 only losing 5% of its number, while Z from which it was derived loses twice as much and is at a disadvantage. You can thus see how Z might be transformed into quite a different looking form, Z^1, though still preserving the essential structural qualities of Z. There is no need for anything but superficial appearances to be affected, and this is exactly what we find is the case in mimicry.

Note also that A will gain by the resemblance to it of Z^1. For the resemblance works in both directions, provided that each member of the pair is distasteful: if A is first eaten the memory of its appearance and unpleasant character will prevent Z^1 from being eaten afterwards, just as Z^1 eaten first will protect A.

Such mutually advantageous resemblances are known as Common warning colours or by Poulton's technical name Synaposematic resemblance: "Müllerian mimicry" is also used in contrast with Batesian mimicry.

The more plentiful each species is, the easier it is for the enemy to learn his lesson. Note that synaposematic resemblance diminishes the amount of work to be done by an enemy in finding his

specific characters, but without success; and, therefore, the descriptions which follow make no reference to the arrangement of the bristles and hairs of the thorax, tibiae and abdomen, the relative lengths of the tarsal segments, the pleural hairs, etc. The females closely resemble the males, but have a wider face, longer wings and more slender legs without spines near the base of the posterior femora; unless associated with males they can rarely be determined with satisfaction, as they lack the distinctive structural characters of the males.

The nine previously described species are *fasciata* Fabricius, 1775; *robertii* Macquart, 1838; *caffra* Macquart, 1846; **aequalis* Loew, 1857; **trichozona* Loew, 1857; **floccosa* Kirby, 1884; **xanthotricha* Bezzi, 1908; **gossypiata* Speiser, 1910; **mediospinosa* Speiser, 1913. Of these I have seen types of the six species marked with an askerisk.

According to V. von Röder (1890, 'Ueber *Asilus fasciatus* Fabr.', *Ent. Nachr.*, **16**: 109-10) the type of *fasciata* is at Copenhagen, but Dr. Lundbeck informs me that the specimen to which Röder refers is not the actual type, although it came from an old collection and was probably determined by Fabricius. *B. fasciata* was described from the Drury collection, and on Drury's death the collection was sold by public auction. A catalogue of the Sale with manuscript notes, preserved in the library of the Hope Department at Oxford, shows that his collection of Asilidae was sold to Kirby. This Lot most probably included the type of *fasciata*; I have been unable to trace its subsequent history. In 1821, Wiedemann redescribed *fasciata* from a specimen still preserved at Vienna. I have compared this insect with the one sent from Copenhagen and believe the two to be conspecific; in the absence of the actual type I accept them as representing the true *fasciata* of Fabricius.

One of the chief differences between *fasciata* and *aequalis* given by Loew in the original descriptions of the latter was a difference in the colour of the mystax, although he suspected an error in Wiedemann's description. Loew's suggestion was investigated by Röder, who showed that the mystax of *fasciata* was yellow like that of *aequalis*, not black as described by Wiedemann. On these grounds Kertész placed *aequalis* as a synonym of *fasciata*, and nearly all later workers on Asilidae have followed him. The two species are, however, quite distinct both as regards the genitalia and more superficial characters. Furthermore, the true *fasciata* is known to me only from West Africa, whereas *aequalis* is essentially an East African species ranging from the type locality in

Caffraria through Natal, Portuguese East Africa, Rhodesia and Nyasaland to Tanganyika.

B. floccosa Kirby was said to have been found in New Zealand, but F. W. Hutton (1901, 'Synopsis of the Diptera Brachycera of New Zealand', *Trans. New Zealand Inst.*, **33**: 21, footnote) omitted it from his list as he considered there must have been a mistake in the locality. He adds: 'There is no such place as Opobo in New Zealand, and so conspicuous an insect could hardly have eluded all our collectors. Perhaps it was collected at Opobo, in West Africa.'

The type specimen bears:—(i) Kirby's type label, (ii) a museum label giving as locality Opabo, N. Zealand, (iii) a smaller and evidently older label bearing the single word Opobo. The museum catalogue number is 80.33 and the book-entry corresponding to these figures agrees with that on the label (ii). J. G. Bartholomew (1922, 'The Times Survey Atlas of the World', London, Pl. 76) gives Opobo and Opobo River in Southern Nigeria. *B. floccosa* very closely resembles *B. fasciata* and although the two species were considered identical by Ricardo (1913, 1920) the aedeagus shows them to be distinct and the name *floccosa* should be restored to the list.

B. caffra Macquart is described as having the *first two* abdominal segments with white hairs and the legs with yellowish bristles and hairs. As is pointed out by Loew, it is possible that this description is erroneous and that Macquart intended to refer to the second and third abdominal segments, which in the *fasciata* group are always more conspicuously clothed with hair than is the basal segment. If Loew's suggestion be correct, then *caffra* must be considered as one of the *fasciata* group, but among the hundreds of specimens of the group which I have examined not one has the bristles of the legs yellowish, and the species remains unknown to me. Only an examination of the type can enable the identity of *caffra* to be established with any degree of satisfaction, but unfortunately it is not with other types of Macquart in the Bigot collection at Oxford or in the Paris Museum, and I have failed to trace it elsewhere. It may be that *caffra* belongs to some other group.

The only other type which I have not seen is that of *robertii* Macquart, described from a single female from Senegal as having the first three abdominal segments with yellow hairs, whereas throughout the *fasciata* group the hairs of the second and third abdominal segments are typically white. In many museums it has been the custom to assign all yellow-banded specimens to *robertii*, because no other yellow-banded species had been described, and

the numerous specimens purporting to be *robertii* in such museums are not only from various localities, but appear to embrace more than one species. The fact that they are *all females* strongly suggests some kind of sexual dimorphism or polymorphism, but the problem is not a simple one for the following reasons :—(i) Several species appear to be involved. (ii) Two yellow-banded *males* were recently discovered amongst undetermined material, these having terminalia which are apparently indistinguishable from those of *fasciata*, a species of which a long series of white-banded males and females is known. (iii) White-banded females of many species are known. Until specimens are taken *in copula* or other evidence of their true affinities is forthcoming, it is clearly impossible to determine these yellow-banded females or the precise status of the name *robertii*.

The remaining names represent distinct species without presenting special difficulties.

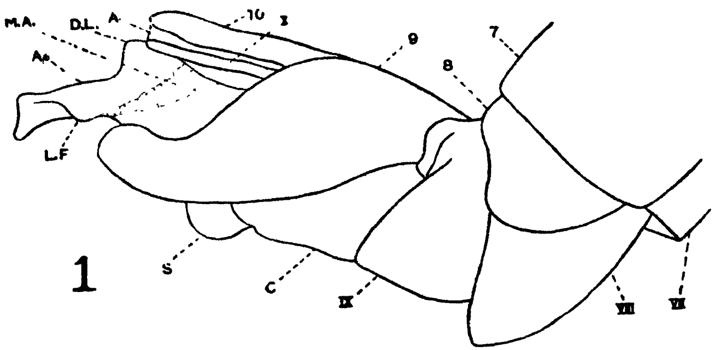

FIG. 1.—*fasciata* F.; male terminalia, lateral view. Arabic numerals—tergites; roman numerals—sternites. A—anus; Ae—aedeagus; C—coxite of ninth sternite; D.L.—dorsal lobe of aedeagus; L.F.—lateral flange of aedeagus; M.A.—membranous area separating distal and basal parts of aedeagus; S—style attached to coxite of ninth sternite. The ninth tergite is divided into right and left halves which are the so-called 'upper forceps.' The tenth segment is the so-called 'anal segment.'

V. STRUCTURE OF THE MALE TERMINALIA IN THE *FASCIATA* GROUP.

The male terminalia (Figs. 1 and 7) consists of the eighth, ninth and tenth segments. The eighth tergite is about half as long as broad, and is partially retracted beneath the seventh tergite so that only the latero-distal angles remain prominent. The eighth sternite is usually strongly convex and about twice as long as broad; the distal extremity is rounded or truncate. The ninth tergite is divided

longitudinally into two halves forming the so-called 'upper forceps,' which may be short or long, narrow or broad, straight or curved. The ninth sternite is about one-and-a-half times as broad as long, and with or without a membranous area in its distal margin. It bears a coxite (C) with which is articulated a curved style (S) sometimes showing specific differences in the wing-like expansions near its base. The tenth segment surrounds the anus, tergite and sternite each being divided longitudinally into two halves separated from one another by a membranous area. The aedeagus (Ae)[2] extends posteriorly between the paired coxites and styles, but is slightly more dorsal in position. At its base is a membrane connecting with the body wall. Towards the apex is a membranous area (M.A.), somewhat triangular in shape as viewed from the side, which has its base on the dorsal surface and extends posteriorly and ventrally (*Cf.* Fig. 1 ; in other figures only the position of the base of this membranous area is indicated). The form of the aedeagus, as seen in both lateral and dorsal view, is of the highest systematic importance.

VI. Acknowledgements.

I desire to acknowledge my indebtedness and to express my sincere thanks to the following naturalists without whose kind assistance it would have been impossible to undertake this investigation. To Major E. E. Austen, Prof. G. D. H. Carpenter, Sir Edward B. Poulton and Capt. N. D. Riley for the many facilities received in the British Museum (Natural History) and the Hope Department of Entomology, Oxford University Museum. To Messrs. J. E. Collin and C. J. Wainwright for information concerning the terminalia of Diptera. To Mr. A. Cuthbertson for material from the Department of Agriculture, Salisbury, S. Rhodesia. To the late Dr. F. A. Dixey and Dr. R. Hanitsch for advice on nomenclature. To Dr. R. Hanitsch for help in reading works in the German language. To Dr. F. W. Edwards for facilities for studying the type of *B. floccosa* Kirby and other specimens from the British Museum, many valuable suggestions and kind criticism of the manuscript. To Dr. H. Eltringham for advice on the technique of preparing genitalia. To Dr. G. Enderlein for the loan of the type of *B. trichozona* Loew and other specimens from the Zoologisches Museum der Universität, Berlin. To Dr. W. Lundbeck for a specimen of *B. fasciata* F. probably determined by Fabricius and for other specimens from the Univer-

[2] For a detailed account of the structure of the aedeagus see Reichardt (*loc. cit.*).

sitetets Zoologiske Museum, Copenhagen. To Mons. A. d'Orchymont for the type of *B. xanthotricha* Bezzi and other specimens from the Musée Royal d'Histoire Naturelle de Belgique, Brussels. To Dr. Hans Sachtleben for specimens from the Deutsches Entomologisches Institute der Kaiser Wilhelm Gesellschaft, Berlin. To Dr. H. Schouteden for specimens from the Musée du Congo Belge, Tervueren. To Mons. E. Séguy for searching for types in the Museum National d'Histoire Naturelle, Paris. To Dr. P. Speiser for the three types of *mediospinosa* Speiser and for correspondence on the group. To Prof. Y. Sjödstedt for the type of *B. aequalis* Loew and a paratype of *B. gossypiata* Speiser from the Naturhistoriska Riksmuseum, Stockholm. To Dr. H. Zerny for Wiedemann's specimen of *B. fasciata* F. and other specimens from the Naturhistorisches Museum, Vienna. To Miss M. E. Prestidge for typing the manuscript.

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VII. List of Species.

1. *fasciata* Fabricius, 1775, Sierra Leone, Guinea, Liberia; ? Ashanti, Nigeria, Senegal and Fernando Po.
2. *floccosa* Kirby, 1884 [New Zealand], ? Nigeria.
3. *xanthotricha* Bezzi, 1908, Belgian Congo, Angola.
4. *niveicincta* sp. nov., Uganda, Tanganyika, Belgian Congo.
5. *trichozona* Loew, 1857, Guinea, Gold Coast, Dahomey, Nigeria.
6. *aequalis* Loew, 1857, Caffraria, Natal, Portuguese East Africa, Rhodesia, Nyasaland, Tanganyika, Kenya.
7. *gossypiata* Speiser, 1910, Tanganyika, Nyasaland.
8. *acuminata* sp. nov., Nyasaland, Tanganyika.
9. *conradti* sp. nov., Nigeria.
10. *neavei* sp. nov., Nyasaland, Tanganyika.
11. *mixta* sp. nov., Uganda, Tanganyika.
12. *entebbensis* sp. nov., Uganda.
13. *crassifemorata* sp. nov., Cameroons.
14. *carpenteri* sp. nov., Uganda, Tanganyika.
15. *venatrix* sp. nov., Kenya.
16. *promiscua* sp. nov., Belgian Congo.
17. *wollastoni* sp. nov., Uganda, Kenya.
18. *cornuta* sp. nov., ? Uganda.
19. *erythrosceles* sp. nov., Belgian Congo, Uganda.

20. *rufotibialis* sp. nov., Africa.
21. *versicolor* sp. nov., Rhodesia, Belgian Congo.
22. *hastata* sp. nov., Belgian Congo, Tanganyika, ? Portuguese Congo.
23. *calcarata* sp. nov., Ashanti.
24. *zenkeri* sp. nov., Cameroons.
25. *mediospinosa* Speiser, 1913, Cameroons, Nigeria.
26. *speiseri* sp. nov., Nigeria.
27. *mesacantha* sp. nov., Nigeria, Liberia.
28. *mesorrhachis* sp. nov., Sierra Leone, Ashanti.

Species incertae.

29. *caffra* Macquart, 1846, Caffraria.
30. *robertii* Macquart, 1838, Senegal.

VIII. Grouping of Species.

I do not propose to give a key to species, as I believe determinations may be made more easily and more accurately by reference to the figures of the male terminalia. The following grouping of species is purely tentative and will need to be modified as more species are described.

In the first instance the *fasciata* group may be divided into two sections according to the position of the spines on the posterior femora of the male, *viz.* near the base (*fasciata* section), or near the middle (*mediospinosa* section). The latter section contains only four species: *mediospinosa, speiseri, mesacantha* and *mesorrhachis*, of which the first three are more closely allied to one another than to the last. The species of the *fasciata* section may further be grouped as follows :—

1. Upper forceps strongly curved inwards at the tips. Five species (*fasciata, floccosa, xanthotricha, niveicincta* and *trichozona*) of which the first three are more closely allied to one another than to the others, and the last is the most distinct.
2. Upper forceps short; distal part of aedeagus with a triangular latero-ventral process. Two species (*aequalis* and *gossypiata*).
3. Aedeagus acuminate. Two species (*acuminata* and *conradti*).
4. Upper forceps short; apex of aedeagus with two downwardly directed processes; most of the bristles yellow. One species (*neavei*).
5. Upper forceps long; aedeagus simple in lateral view, but with good specific characters in dorsal view. Six species (*mixta, entebbensis, crassifemorata, carpenteri, venatrix and promiscua*).
6. Upper forceps short and ovate; aedeagus almost parallel-sided. One species (*wollastoni*).
7. Upper forceps long; aedeagus broad as seen from the side. One species (*cornuta*).

8. Legs partly reddish; upper forceps long, aedeagus as seen from above somewhat expanded distally. Two species (*erythrosceles* and *rufotibialis*).
9. Apex of aedeagus spear-like as seen from above. Two species (*versicolor*, with legs partly testaceous, and *hastata* sometimes having cell R_5 closed).
10. Posterior tibiae of the male with a large spur, aedeagus with remarkable wing-like lateral processes. One species (*calcarata*).
11. Upper forceps long, distal part of aedeagus ovate as viewed from above. One species (*zenkeri*).

In addition to the above there are two *species incertae*; *caffra* said to be distinguished by the yellow bristles of the legs, and *robertii* with yellow hairs on the first three abdominal segments.

IX. Description of Species.

1. *Bactria fasciata* Fabricius.

1775. *Asilus fasciatus* Fabricius, Systema Ent., 793.7.
1805. *Laphria fasciata* Fabricius, Systema Antilat., 158.11.
1821. *Asilus fasciatus* Wiedemann, Dipt. Exot., 208.45.
1838. *Trupanea fasciatus* Macquart, Dipt. Exot., **1** (2): 92.
1858. *Promachus fasciatus* Bigot, in Thomson's Archiv. Ent., **2**: 354.
1890. *Promachus fasciatus* Röder, *Ent. Nachr.*, **16**: 109.
1910. *Promachus fasciatus* Speiser, Kilimandjaro Meru Exp., **10** (4): 96.
1920. *Promachus fasciatus* Ricardo (*partim*), *Ann. Mag. Nat. Hist.*, ser. 9, **5**: 171.

For other references see Kertész, 1909, Cat. Dipt., **4**: 219.

♂ ♀. Length of body 16-22 mm., of wing 11-17 mm.

♂. *Head.* Mystax entirely or chiefly yellow, outer and upper bristles often black; lateralia usually with black bristles and hairs, sometimes with a few yellow. Greatest width of eye about twice the width of face at narrowest point. Palps above and distally with bristles black, below and basally with bristles yellow. Beard yellow. Occipital bristles, the hairs above them and on the frons black. Antennae black, the basal segments with black hairs; antennal segments varying considerably in relative length, but usually with the basal and third segments subequal, each about twice as long as the second segment and less than half as long as the style, the third segment from three to four times as long as broad.

Thorax. Pronotum with both black and yellow hairs and a row of six to twelve black bristles. Mesonotum black without distinct stripes, at the sides with dark brownish pruinescence; hairs and bristles black except for a *few* yellow hairs occasionally present anteriorly, above the wing bases and on the post-alar calli. Scutellum usually with all the hairs and bristles black, sometimes with the hairs yellow.

Legs. Legs black with black bristles and both black and yellow hairs. Anterior femora without bristles on posterior surface; length of posterior femora about four-and-a-half times the dorso-ventral diameter, about one-and-a-third times the length of posterior tibiae. Basal third of posterior femora with a slight postero-ventral swelling bearing a group of about twelve spines; ventral surface with a row of about five similar spines (some of which may be present in duplicate); postero-ventral surface with an oblique row of about four spines extending distally towards the posterior surface. Posterior tibiae slightly curved, longer than the tarsal segments together, slightly swollen distally where they bear a pad of very short spines.

Wings. Smoky, rather dark; cell 2nd R_3 with a large lanceolate greyish spot; costa with black bristles at the base.

Abdomen. Dorsal surface black with thin brownish-grey pruinescence at the sides; the first segment with a narrow band of hairs which varies considerably in colour; the second and third segments each with transverse tufts of long white hairs; the four following segments with short black bristles on the disc and at the sides with longer hair-like bristles which are usually black, although some or all may be whitish or yellowish; the eighth tergite shining black with black bristles. Ventral surface black; the first seven sternites with brownish-grey pruinescence and long whitish, yellowish or black hairs; the eighth sternite shining black with long erect black hairs, convex, rounded distally, not truncate. Upper forceps (ninth tergite) shining black with black bristles, broadest about the middle, narrower distally and extending beyond the anal (tenth) segment; the tips strongly curved inwards; length about two-and-a-half times the greatest breadth. Ninth sternite about twice as broad as greatest length and with a weakly chitinised median area in the distal margin. Basal part of aedeagus without ventral lobe, distal part with a dorsal lobe and on each side with a broad lateral flange (Figs. 1, 2 and 31).

♀. Resembles the male. Distinguished from the female of *P. mesorrhachis* by the latero-distal tuft of black bristles on each side of the eighth abdominal tergite.

Specimens seen: SIERRA LEONE:—A female probably determined by Fabricius, labelled 'Sierra Leone et Guinea' (Pflug, Copenhagen Mus.). 1 ♂, Baiama, 10.viii.1912; 2 ♂♂, Bambetuk, 11.x.1912; 4 ♂♂, Bo, 1-3.ix.1912; 1 ♂, Daru, 31.viii.1912; 1 ♀, Ghangbama, 9.x.1912; 3 ♂♂, 5 ♀♀, Jarra, 9.ix.1912; 1 ♂, Jowati, 10.viii.1912; 1 ♂, Mongheri, 14.ix.1912; 1 ♀, Moyamba, 25.ix.1912; 1 ♀, Rotifunk, 14.x.1912; 1 ♀, Senahu, 13.x.1912; 1 ♂, Tikonko, 31.viii.1912 (all *J. J. Simpson*, Brit. Mus.). 1 ♀, Maramu, 11.x.1924 (*E. Hargreaves*, Brit. Mus.). 2 ♂♂ without further data (Hope Dept.). GUINEA:—1 ♂, Sannum (Copenhagen Mus.). The male described by Wiedmann (1821) (Coll. Winthem, Vienna Mus.). LIBERIA:—1 ♂, Ghanga, ix.1926 (*J. Bequaert*, Mus. Congo).

Note.—In addition to the above I have seen the following specimens which may belong to this species. 1 ♂, ASHANTI,

Kumasi, 21.x.1907, on leaf in bush path (*W. M. Graham,* Brit. Mus.). Differs from typical specimens in being more robust and in having the dorsal lobe of the aedeagus more strongly developed. 1 ♀, NIGERIA, Asaba, R. Niger (*W. H. Crosse,* Brit. Mus.); 1 ♀, ? SENEGAL (Brit. Mus.); 1 ♀, Fernando Po., Sta. Isabel, 23.vii.1900 (*L. Conradt,* Deut. Inst.). These females are not associated with males taken at the same time and place and it is impossible to be quite certain of the determination. 1 ♂, BELGIAN CONGO, Yambata, ii-iii.1914 (*De Giorgi,* Mus. Congo.). Closely resembles *B. fasciata* in the structure of the aedeagus, but has yellow hairs on the three basal abdominal segments.

2. *Bactria floccosa* Kirby.

1884. *Promachus floccosus* Kirby, *Trans. Ent. Soc. Lond.,* **1884**: 273.

1901. *Promachus floccosus* Hutton, *Trans. New Zealand Institut.,* **33**: 21, footnote.

1913. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.,* Ser. 8, **11**: 413.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.,* Ser. 9, **5**: 172.

♂. Length of body 22 mm., of wing 16 mm.

♂. Closely resembles *B. fasciata,* but differs in having the dorsal lobe of the aedeagus much more strongly developed and elongate (Fig. 3).

Specimen seen: The male holotype (*H. W. Marsden,* Brit. Mus.) said to be from NEW ZEALAND, but more probably from S. NIGERIA (see p. 187).

3. *Bactria xanthotricha* Bezzi.

1908. *Promachus xanthotrichus* Bezzi, *Ann. Soc. Ent. Belg.,* **52**: 378.

1910. *Promachus xanthotrichus* Speiser, Kilimandjaro Meru Exp., **10** (4): 96.

1920. *Promachus xanthotrichus* Ricardo (*partim*), *Ann. Mag. Nat. Hist.,* Ser. 9, **5**: 180.

Closely allied to *B. fasciata* from which it differs in the following characters.

♂ ♀. Length of body 17-20 mm., of wing 12.5-15 mm.

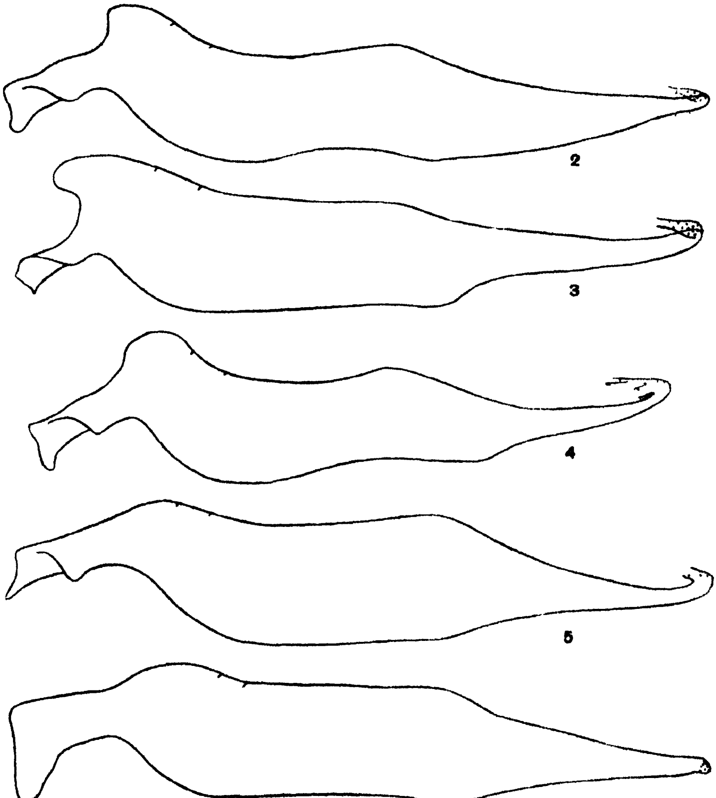
♂. *Head.* Mystax and palps with all the hairs and bristles yellow; lateralia with all or most of the hairs yellow. Occiput with black and yellow bristles intermixed or with all the bristles yellow. Frons with a few yellow hairs.

Thorax. Scutellum with all the hairs and all or most of the bristles yellow.

Abdomen. Aedeagus with dorsal lobe more rounded and almost semicircular as viewed from the side, the lateral flange broader as viewed from above (Fig. 4).

♀. Resembles the male.

Specimens seen: ANGOLA:—1 ♂ (Brit. Mus.). BELGIAN CONGO:—The male holotype, Riv. N'Gamie, Chute de Semlia (*Mocquereys*, Brussels Mus.). 1 ♂, 1 ♀, Congo da Lemba, 1912 (*R. Mayné*, Mus. Congo).



FIGS. 2—6.—Aedeagus, lateral view. 2, *fasciata* F.; 3, *floccosa* Kirby; 4, *xanthotricha* Bezzi; 5, *niveicincta* sp. nov.; 6, *trichozona* Loew.

4. **Bactria niveicincta** sp. nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 172.

Related to *B. fasciata* from which it differs in the following characters:—

♂. Length of body 18-21 mm., of wing 13-14 mm.

food, for he has only to remember that all insects of a certain appearance are unpleasant. Thus there need be, *a priori*, no limit to its extent—the more species that join in, the better for everybody, both predator and prey. Provided, that is, that *all* are distasteful.

You may say, why then are not *all* insects members of a synaposematic combination? Because insect-eaters must eat something, and edibility is entirely relative. A man put in front of a varied menu will pick and choose, but a castaway will eat his leather belt and boots! If all insects had an unpleasant quality the predators would simply distinguish between degrees of unpleasantness and the result would be the same as if some were pleasant and others unpleasant.

I find that this question of the *relativity* of edibility is one which critics either ignore or do not understand, and one frequently finds an observer triumphantly disproving the whole theory of mimicry because he has seen an aposematic insect devoured by some enemy.

The Müllerian theory has a further complication which was only hinted at by Müller but was brilliantly elaborated independently by the late Dr. F. A. Dixey, F.R.S. This can only be briefly mentioned as follows. Instead of Z going all the way to meet A, and becoming Z^1, like A but unlike Z, it is conceivable that A might go half way to meet Z, and Z would not have to give up all its characteristic appearance in order to look like A. The result would be AZ in which A retains some of its characteristics which only affect its appearance in minor details while the broad features are like Z; and ZA which is broadly like A, but retains minor features peculiar to the group to which Z belongs.

With this final development of the complicated phenomena, all loosely classed as "Mimicry," I must close the address, but before finally doing so I would again remind you of the facts which Darwin's theory of natural selection has illuminated and vivified as no other theory which has yet been put forward can do. I would state again, boldly, that the whole phenomena of coloration in insects, concealing, warning and mimetic, have never been explained on any one theory other than natural selection.

The following are the significant facts.

1. The association of bright colours, conspicuous patterns and habits of display with possession of some unpleasant quality and toughness resisting injury.
2. Such associated qualities are not found in insects which are concealed from daylight: that is, there is meaning in them.

♂. *Head.* Mystax with the central bristles yellow or white, the outer and upper bristles black; lateralia with black bristles and hairs. Greatest width of eye slightly more than twice the width of face at narrowest point. Beard yellow or white.

Thorax. Mesonotum and scutellum with all the hairs black.

Legs. Pale hairs less abundant and sometimes white instead of yellow. Posterior femora with ventral row of spines reduced to two or three spines only, the oblique row reduced in number or absent. Posterior tibiae with fewer spines in the ventro-distal pad, the spines arranged in two series meeting distally and enclosing a bare area.

Abdomen. The first tergite with white hairs, at the sides some of the hairs black; the fourth and following segments above with the hair-like bristles at the sides black. The first three sternites with long white hairs, the following sternites with black or both black and white hairs. Upper forceps (ninth tergite) broader distally. Aedeagus with the dorsal lobe scarcely present (Fig. 5).

Holotype:—♂, UGANDA, Budongo Forest, Unyoro, 3400 ft., 11-15.xii.1911 (*S. A. Neave*, Brit. Mus.). *Paratypes*:—UGANDA, 1 ♂, Budongo Forest, Unyoro, 3400 ft., 11-15.xii.1911 (*S. A. Neave*, Brit. Mus.); 1 ♂, W. shores of Victoria Nyanza, Buddu, 3700 ft., 19-25.ix.1911 (*S. A. Neave*, Brit. Mus.). TANGANYIKA:—1 ♂ (*Potts*, Hope Dept.). BELGIAN CONGO:—1 ♂, Uelé (*Dr. Rodhain*, Mus. Congo); 1 ♂, Bokote, 12.vi. 1926 (*R. P. Hulstaert*, Mus. Congo).

5. *Bactria trichozona* Loew.

1857. *Promachus trichozonus* Loew, Öfvers Kongl. Vet. Akad. Förhandl., **14**: 359, 59.

1860. *Promachus trichozonus* Loew, Dipt.-Fauna Südafrika's, **1**: 129. 1 *bis*.

1910. *Promachus trichozonus* Speiser, Kilimandjaro Meru Exp., **10** (4): 96.

1920. *Promachus trichozonus* Ricardo, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 170.

Related to *B. fasciata*, but distinguished by the yellow hairs on the frons and the following characters:—

♂ ♀. Length of body 17-20 mm., of wing 12-14 mm.

♂. *Head.* Mystax entirely yellow, lateralia with yellow hairs. Face slightly narrower relatively to width of eye. Palps usually with all the bristles yellow, sometimes with a few black bristles distally. Occipital bristles usually black, sometimes a few or all yellow, the hairs above them and on the frons chiefly yellow. The two basal antennal segments usually with both black and yellow hairs.

Thorax. Hairs and bristles black except anteriorly, posteriorly, above the wing bases and on the post-alar calli where invariably some of the hairs are yellow. Scutellum with yellow hairs and both black and yellow bristles.

Legs. Length of posterior femora about five times the dorso-ventral diameter. Postero-ventral group of spines not situate on a distal swelling,

not very compact, some of the spines rather long; the oblique row either absent or represented only by one or two spines.

Wings. Not so dark as those of *P. fasciata;* cell 2nd R_3 with a smaller lanceolate greyish spot.

Abdomen. Dorsal surface black with a distinct band of yellowish-grey pruinescence at the sides; first segment with a narrow band of yellowish hairs; fourth, fifth, sixth and seventh segments with the bristles at the sides and sometimes also a few on the disc and along the hind margins of the segments yellow. The first seven sternites with long whitish or yellowish hairs. Aedeagus of the same type as that of *B. fasciata,* but distal part with a smaller dorsal lobe and without lateral flange (Figs. 6 and 34).

♀. Closely resembles the male, although the mystax sometimes has a few of the bristles black and the scutellar bristles may all be yellow.

Specimens seen: GUINEA :—The male holotype (Berlin Mus.); 1 ♂ (Bigot Coll.). GOLD COAST :—1 ♂, N. Territories, Dimawo, 16.vii.1914 (*J. J. Simpson,* Brit. Mus.). DAHOMEY :—1 ♂, 1-5.v. 1894; 1 ♂, 15.v.1894; 1 ♂, 1894; all from Misahöhe, Togo (*E. Baumann,* the first two in Berlin Mus., the last in Deut. Inst.). NIGERIA : — ♂ and ♀ *in copula,* 26.ix.1913; 2 ♀♀, 28.vi.1913 (*W. A. Lamborn*); 1 ♀, 9.xi.1913 (*C. O. Farquharson*); all from Ibadan, Moor Plantation (Hope Dept.). 1 ♀, S. Nigeria, 1912 (*A. D. Peacock,* Brit. Mus.). WEST AFRICA :—1 ♂ (Hope Dept.). NO DATA :—1 ♂ (Copenhagen Mus.); 1 ♂ (Bigot Coll.).

6. *Bactria aequalis* Loew.

1858. *Promachus aequalis* Loew, Öfvers. Kongl. Vet. Akad. Förhandl., **14**: 358. 58.

1860. *Promachus aequalis* Loew, Dipt.-Fauna Südafrika's **1**: 127.1, tab. 1, fig. 50.

1890. ?*Promachus fasciatus* Röder (*partim*), *nec* Fabricius, *Ent. Nachr.,* **16**: 109.

1905. *Promachus aequalis* Adams, *Kansas Univ. Sci. Bull.,* **3**: 152.

1909. *Promachus fasciatus* Kertész (*partim*), *nec* Fabricius, Cat. Dipt., **4**: 216, 220.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.,* Ser. 9, **5**: 171.

1920. *Promachus xanthotrichus* Ricardo (*partim*), *nec* Bezzi, *Ann. Mag. Nat. Hist.,* Ser. 9, **5**: 180.

Closely allied to *P. gossypiata* Speiser.

♂♀. Length of body 15-23 mm., of wing 13-18 mm.

♂. *Head.* Mystax entirely or almost entirely yellow, sometimes with a few of the outer hairs black; lateralia usually with yellow hairs. Greatest width of eye about one-and-three-quarter times the width of face at narrowest point. Palps with all the bristles and hairs yellow or with both black and yellow ones. Occipital bristles usually black, but sometimes with a few

yellow, the hairs above them and on the frons sometimes black, sometimes black and yellow intermixed. The two basal antennal segments with all the hairs black or with some black, others yellow.

Thorax. Pronotum usually with both black and yellow hairs and a row of black bristles, sometimes with a few of the bristles and all the hairs yellow. Mesonotum with a broad medio-dorsal blackish stripe subdivided longitudinally, and on each side with a broad latero-dorsal blackish stripe subdivided transversely into two large spots and a small triangular posterior spot; pruinescence at sides and between the spots yellowish-brown. Hairs black except for a few yellow ones often present anteriorly, posteriorly and above the wing bases. Scutellar bristles black or black and yellow intermixed; the hairs yellow or black and yellow intermixed.

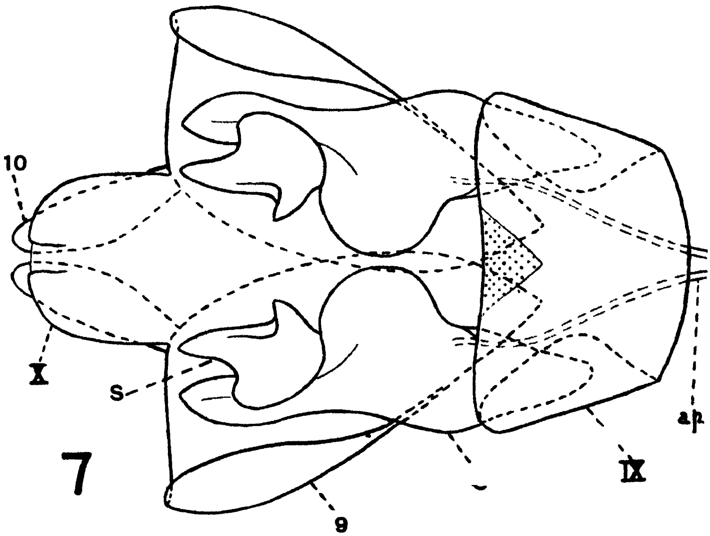


FIG. 7.—*aequalis* Loew, male terminalia, ventral view, aedeagus removed. Arabic numerals—tergites; roman numerals—sternites; ap—apodeme; c—coxite; s—style.

Legs. Yellow hairs more abundant than in *B. fasciata.* Length of posterior femora about four times the dorso-ventral diameter. The group of spines near the base of the posterior femora more compact and situate on a more prominent swelling than the corresponding group in *B. fasciata*; the ventral row consisting of about seven spines which are rarely present in duplicate and which are more closer together than the corresponding spines in *B. fasciata;* the oblique row of spines either absent or at the most represented by one or two spines. Posterior tibiae not so distinctly curved as those of *B. fasciata.*

Wings. Not so dark as those of *B. fasciata;* cell 2nd R_3 with lanceolate greyish spot rather smaller than that in *B. fasciata;* costa with yellow bristles at the base.

Abdomen. Dorsal surface black with a distinct band of greyish-brown

pruinescence at the sides; the first segment with a narrow band of hairs which are usually entirely or largely yellowish, although sometimes a few of the hairs are black and rarely all may be white; the fourth, fifth, sixth and seventh segments with the long hair-like bristles at the sides chiefly yellow, although sometimes with whitish and nearly always with black bristles intermixed; the sixth and seventh segments (and rarely the fifth) sometimes with yellow bristles along the hind margins and others on the disc. The first seven sternites with greyish pruinescence, yellow bristles and hairs; the eighth sternite somewhat truncate, the long bristles yellow or black and yellow intermixed. Upper forceps (ninth tergite) short, somewhat pear-shaped, about twice as long as broad, not extending beyond the anal (tenth) segment, the tips scarcely turned inwards; the bristles usually black, sometimes with a few yellow. Ninth sternite as in *B. fasciata*. Basal part of aedeagus with a ventral lobe; distal part on each side with a triangular latero-ventral process, but without a distinct dorsal lobe (Figs. 7, 8 and 32).

♀. Closely resembles the male. Distinguished from the females of *B. gossypiata* by the lighter thoracic pruinescence and the more slender ovipositor

Specimens seen: CAFFRARIA:—The female holotype (Stockholm Mus.). NATAL:—1 ♂, iii.1897; 1 ♂, 5.ii.1908; both from Malvern (*G. A. K. Marshall*, Brit. Mus.). 1 ♂, Malvern, 700-800 ft., 19.i.1904 (*C. N. Baker*, Hope Dept.). 1 ♂, 1 ♀, Zululand, Eshowe, 23.iii.-22.iv.1926 (*R. E. Turner*, Brit. Mus.). PORTUGUESE EAST AFRICA:—1 ♂, Delagoa Bay (Bigot Coll.). 1 ♀, Delagoa (*W. Distant*, Brit. Mus.). RHODESIA:—8 ♂♂, 12 ♀♀, Mt. Chirinda, 3800 ft., 21.xii.1911—5-20.iii.1912 (*C. F. M. Swynnerton*, Hope Dept.). 7 ♂♂, 11 ♀♀, Mid. Chambezi Valley, Chinsali district, 4000 ft., 12-20.iv.1908 (*S. A. Neave*, Hope Dept.). 1 ♂, Luangwa Valley, Petauke, 2400 ft., 11.i.1908 (*S. A. Neave*, Hope Dept.). 2 ♂♂, 5000 ft., 1899 and 5.ii.1905 (*G. A. K. Marshall*, Hope Dept.); 1 ♀, 5.i.1900 (*R. H. Thomas*, Brit. Mus.); all from Mashonaland, Salisbury. 1 ♀, Mashonaland, Mazee, xii.1905 (*G. A. K. Marshall*, Brit. Mus.). 1 ♂, 1 ♀, Umtali, xii.1934 (Dept. Agric., Salisbury). NYASALAND:—295 ♂♂, 395 ♀♀, Mt. Mlanje and Ruo Valley, nearly all between 10.i.1913 and 18.iv.1913, a few in 1914 (*S. A. Neave*, Brit. Mus.); 1 ♀, Mlanje, i-ii.1914 (*J. B. Davey*, Brit. Mus.); 1 ♂, Port Herald, 24.iv.1913 (*J. E. S. Old*, Brit. Mus.); 3 ♀♀, L. Nyasa, Monkey Bay, ii.1910 (*H. N. Tate*, Brit. Mus.). TANGANYIKA:—3 ♂♂, 1 ♀, Morogoro, 2.v.1922 (*A. H. Ritchie*, Brit. Mus.). 1 ♂, 4.ii.1928; 1 ♂, 1 ♀, 23.iv.1928, Kondoa, (*T. Nash*, Hope Dept.). 2 ♂♂, no further data (*Potts*, Hope Dept.). 1 ♂, near Dar-es-Salam, i.1894 (*Stuhlmann*, Berlin Mus.). KENYA:—1 ♂, Maziwa, Mitatu and Maungu, 14.iii and 4.iv.1897 (*C. S. Betton*, Brit. Mus.).

(*To be continued.*)

THE ETHIOPIAN SPECIES OF THE *FASCIATA* GROUP OF THE GENUS *BACTRIA* (= *PROMACHUS*) (DIPTERA, ASILIDAE).

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(*Continued from p.* 199.)

7. *Bactria gossypiata* Speiser.

1910. *Promachus gossypiatus* Speiser, Kilimandjaro Meru Exp., **10** (4): 97-8.

1920. *Promachus gossypiatus* Ricardo, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 179.

A dark species superficially resembling *B. fasciata*, but more closely allied to *B. aequalis* in the structure of the genitalia.

♂ ♀. Length of body 16-21 mm., of wing 12-17 mm.

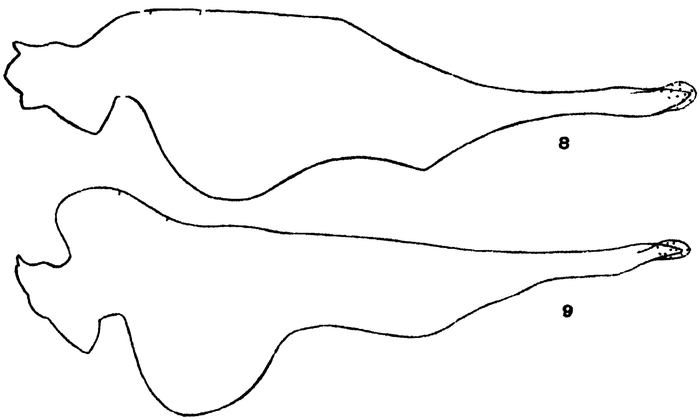
♂. *Head.* Mystax chiefly yellow, outer and upper bristles usually black, lateralia mainly with yellow hairs. Greatest width of eye about one-and-three-quarters the width of face at narrowest point.

Thorax. Mesonotum black without distinct stripes, at the sides with dark brownish pruinescence. Scutellum with black bristles; most of the hairs usually black, although a few, and very rarely nearly all, may be yellow.

Legs. Length of posterior femora about four times the dorso-ventral diameter. Yellow hairs not so abundant as in *B. aequalis*. The posterior femora with the basal group of spines situate on a distinct swelling as in *B. aequalis;* the ventral row consisting of three to eight spines, some of which may be present in duplicate; the oblique row either absent or represented, at the most, by one or two spines. Posterior tibiae distinctly curved as in *B. fasciata*, but the ventro-distal pad of spines even less distinct than in that species.

Wings. Almost as dark as those of *P. fasciata;* costa with a few yellow bristles at extreme base.

Abdomen. The first tergite usually with the hairs yellowish, less frequently with the hairs whitish or black, at the sides almost always with some of the hairs black. The fourth, fifth, sixth and seventh tergites with dark brownish-grey pruinescence at the sides; the long hair-like bristles at the sides usually black, but sometimes a few are yellow. Eighth tergite with the bristles black. Sternites with long black and long yellow hairs; the eighth sternite somewhat truncate, the long bristles black. Upper forceps (ninth tergite) short like those of *B. aequalis*, bristles black. Ninth sternite as in *B. aequalis*, but style of coxite with a much enlarged basal lobe. Aedeagus of the same type as that of *B. aequalis*, but the distal part with a strong dorsal lobe projecting posteriorly and the basal part with a very strong ventral lobe (Figs. 9 and 33).



FIGS. 8 and 9.—Aedeagus, lateral view. 8, *aequalis* Loew; 9, *gossypiata* Speiser.

♀. Closely resembles the male. Distinguished from the females of *B. aequalis* by the dark brown thoracic pruinescence and the stouter ovipositor.

Specimens seen: TANGANYIKA: — 1 ♂ paratype, Usambara, Mombo, vi. (Y. Sjöstedt, Stockholm Mus.). NYASALAND:—18 ♂♂, 12 ♀♀, Mt. Mlanje, 5.xii.1912—17.iii.1913 and 25.ii.1914 (*S. A. Neave*, Brit. Mus.). AFRICA:—1 ♂ from an old collection (Vienna Mus.).

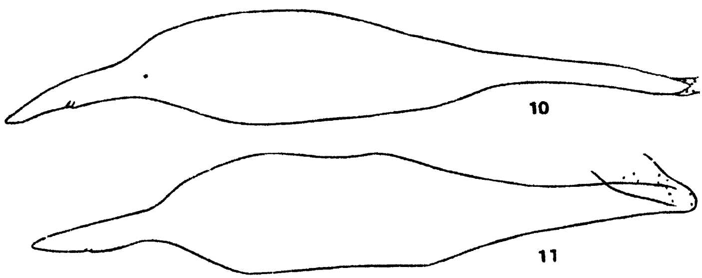
8. **Bactria acuminata** sp.nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 171.

♂. Indistinguishable from *B. aequalis* except by the form of the aedeagus which is acuminate, broadest about the middle, and without dorsal or ventral lobes (Figs. 10 and 35).

Holotype:—♂, NYASALAND, Mt. Mlanje, 15.iii.1913 (*S. A. Neave*, Brit. Mus.). *Paratypes*: NYASALAND:—4 ♂♂, Mt. Mlanje, 5.ii.1913, 6.ii.1913, 17.ii.1913 and 20.iii.1913 (*S. A. Neave*, Brit. Mus.). TANGANYIKA: — 1 ♂ without further data (*Potts*, Hope Dept.).

Note.—The aedeagus of this species (and of *B. conradti*) is of a type rather different from that of the remaining species of the *fasciata* group. Mr. J. E. Collin (in conversation, and with only my drawings before him) suggested the possibility that the specimens on which these two species were based might be intersexual forms. Acting upon his suggestion I searched for the actual opening of the male genital duct as this is often closed in intersexual individuals. The specimens examined showed this duct leading to the exterior quite clearly and all had the remaining terminal abdominal structures of the usual male type. On these grounds, therefore, I prefer for the time being to consider *B. acuminata* and *B. conradti* as distinct species, but I must confess that I am a little puzzled by the morphology of the aedeagus and eagerly await the discovery of more material.



FIGS. 10 and 11.—Aedeagus, lateral view. 10, *acuminata* sp. nov.; 11, *conradti* sp. nov.

9. **Bactria conradti** sp. nov.

Resembles *B. acuminata* in the form of the aedeagus, but is distinguished by the following characters :—

♂ ♀. Length of body 20-21 mm., of wing 14-15 mm.

♂. *Head.* Mystax, lateralia, palps, occiput and frons with bristles and hairs yellow. Ocellary tubercle posteriorly with both black and yellow hairs. The basal antennal segment with nearly all the hairs yellow. Beard whitish-yellow.

Thorax. Pronotum with yellow hairs and bristles. The whole mesonotum with dense brown pruinescence covering the black stripes; bristles and hairs black except for several bristles which are yellow, and yellow hairs anteriorly, posteriorly, above the wing bases and on the post-alar calli. Scutellum with all the hairs and many of the bristles yellow.

Legs. Black except the anterior tibiae, which have the posterior surface obscurely reddish-brown, and the middle tibiae, which have the dorsal, posterodorsal and posterior surfaces largely reddish-brown.

Abdomen. Dorsal surface black with a band of yellowish-brown pruinescence at the sides; the first three segments with bands of white hairs dor-

sally and yellow hairs and bristles at the sides; the fourth and succeeding segments with the bristles yellow. Ventral surface with yellow bristles and hairs and yellowish-brown pruinescence. Upper forceps (ninth tergite) short as in *B. acuminata,* but the distal extremities slightly turned *inwards;* the hairs and bristles black and yellow intermixed. Aedeagus similar to that of *B. acuminata,* but stouter (Figs. 11 and 36).

♀. Resembles the male.

Holotype, ♂, and *allotype,* ♀, NIGERIA, Johann-Albrechtshöhe (*L. Conradt,* Berlin Mus.).

Note.—See discussion under *B. acuminata* (p. 233).

10. **Bactria neavei** sp. nov.

1920. *Promachus xanthotrichus* Ricardo (*partim*), *nec* Bezzi, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 180.

Superficially resembles the yellow-bristled forms of *B. aequalis* from which it is distinguished by the yellow occipital bristles.

♂ ♀. Length of body 20-27 mm., of wing 14-21 mm.

♂. *Head.* Mystax, lateralia, palps and occiput with bristles and hairs yellow. Ocellary tubercle with the hairs black, elsewhere the frons usually with the hairs black although sometimes a few of the hairs yellow. Basal antennal segment with nearly all the bristles black, a few of them yellow.

Thorax. Pronotum with yellow hairs and bristles. Mesonotum with a broad medio-dorsal blackish-brown stripe and on each side with a broad latero-dorsal blackish stripe transversely subdivided into two large spots; pruinescence at sides and between the spots yellowish-brown; bristles usually black; anteriorly, posteriorly and above the wing-bases the hairs yellow, elsewhere the hairs black. Scutellum usually with the bristles and hairs yellow, sometimes a few of them black.

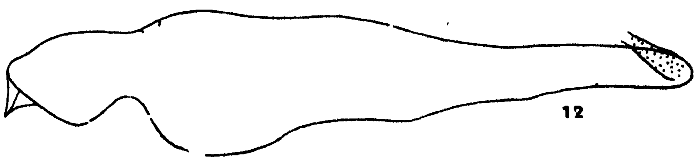

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FIG. 12.—*neavei* sp. nov.; aedeagus, lateral view.

Legs. Black except the posterior and dorsal surfaces of the tibiae, which may be more or less distinctly dull brownish; nearly all the bristles and spines black, sometimes a few of them yellow. Posterior femora about four times as long as the dorsal-ventral diameter, with an oblique row of about four rather widely separated long spines extending distally from the ventral group towards the posterior surface, and with a ventral row consisting of about nine rather shorter spines, some of which may be present in duplicate. Posterior tibiae gently arched, a little longer than the posterior tarsal segments together; slightly swollen distally where there is a ventral pad of very short spines, of which the terminal one is rather longer and forms a *small* tooth-like claw.

Wings. Resembling those of *B. aequalis.*

Abdomen. Black, the first seven tergites with a broad band of yellowish-brown pruinescence at the sides; the first segment either with all the hairs yellow or with some yellow, others white, the bristles at the sides yellow; second and third segments with tufts of white hairs and at the sides with a few yellow hairs; the four succeeding segments with the bristles on the disc black, those at the sides yellow. Ventral surface black, the first seven sternites, with yellowish-brown pruinescence and yellow bristles and hairs, eighth sternite convex, not truncate, the bristles long, sometimes all black, sometimes black and yellow intermixed. Upper forceps (ninth tergite) short and scarcely extending beyond the anal (tenth) segment; about twice as long as broad and rather more ovate than those of *B. aequalis;* with a *small* extension on the posterior margin, near the base of the anal (tenth) segment. Aedeagus with a pair of small downwardly directed triangular processes at the distal extremity (Figs. 12 and 37). Ninth sternite almost entire.

♀. Closely resembles the male.

Holotype, ♂, and *allotype*, ♀, in *copula*, NYASALAND, Mt. Mlanje, 2.i.1913 (*S. A. Neave*, Brit. Mus.). *Paratypes*: NYASALAND: — ♂ and ♀ in *copula*, 21.xi.1912 and 13.xii.1912 (*S. A. Neave*); 46 ♂♂, 83 ♀♀, x.1912—ii.1913 (*S. A. Neave*); 2 ♀♀, ix.1913 — ii.1914 (*J. B. Davey*). All the above from Mt. Mlanje (Brit. Mus.). TANGANYIKA :—1 ♂, Tanga (*Neumann*, Berlin Mus.).

11. **Bactria mixta** sp. nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 171.

Superficially resembles *B. neavei* from which it differs in the following characters :—

♂. Length of body 21-23 mm., of wing 16-17 mm.

♂. *Head.* Mystax usually with some of the outer and upper bristles black, lateralia with some or all of the bristles black. Palps with both black and yellow bristles. Frons with all the hairs black.

Thorax. Pronotum with the bristles black. Mesonotum with pruinescence darker, stripes less distinct and yellow hairs less numerous.

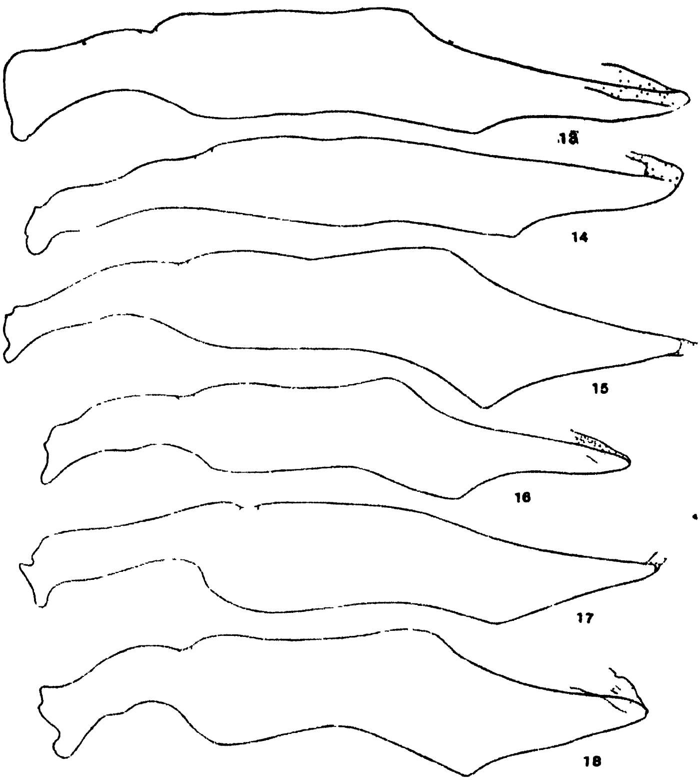
Legs. Anterior femora without or with one or two posterior bristles. The four posterior femora with a few of the bristles yellow. Posterior femora with some of the spines in the basal group yellow, the remaining spines black; ventral row composed entirely or chiefly of yellow spines; oblique row extending towards posterior surface composed of black spines, but partially duplicated by yellow spines. Posterior tibiae less distinctly curved.

Abdomen. The fourth to seventh tergites sometimes with a few yellow bristles on the disc and along the hind margins of the segments. Eighth sternite with short black bristles. Upper forceps (ninth tergite) extending beyond anal (tenth) segment, about three times as long as broad. Ninth sternite with a weakly chitinised median area in the distal margin. Aedeagus without dorsal or ventral lobes, distal part as viewed from above somewhat funnel shaped (Figs. 13 and 38).

♀. Two specimens which I place provisionally as females of this species

closely resemble the males, but have the uppermost occipital bristles black and yellow hairs on the second and third abdominal segments.

Holotype :—♂, UGANDA, Tero, 14.iv.1911 (*C. C. Gowdey*, Brit. Mus.). *Paratypes* : UGANDA :—1 ♂, Tero, 14.iv.1911 ; 1 ♂, Tero Forest, 5.vii.1912 (*C. C. Gowdey*, Brit. Mus.). 2 ♂♂, between Mitiana and Entebbe, 3800 feet, 9-11.i.1912 (*S. A. Neave*, Brit.



FIGS. 13—18.—Aedeagus, lateral view. 13, *mixta* sp. nov. ; 14, *entebbensis* sp. nov. ; 15, *crassifemorata* sp. nov. ; 16, *carpenteri* sp. nov. ; 17, *venatrix* sp. nov. ; 18, *promiscua* sp. nov.

Mus.). TANGANYIKA:—1 ♂, 'Urw.-Mawambi,' 1910 ; 1 ♂, 'Urwald-Beni', x.1910 (*Grauer*, Vienna Mus.). *Females* (*not to be considered as paratypes*) : 2 ♀♀ (Brit. Mus.), mounted in the same way, but without locality label. One of them bears a museum label 'Pres. by the Imp. Bur. Ent., 1921-12', as also do the two males taken by S. A. Neave in Uganda.

3. The unpleasant qualities may be lacking in other insects which resemble the former in appearance, such resemblance being confined to characters taxonomically unimportant. Mimicry deceives the artist, not the anatomist.
4. Mimetic resemblance to a well-known model can be produced by a variety of means in different species, the end result being a superficial similarity only.
5. Mimicry may depend upon a mere trick of gait or attitude without any other special modification.
6. Batesian mimicry (resemblance of a defenceless species to a protected one) appears to be rare.
7. Mullerian resemblance between sundry protected species benefits (up to a point) by the abundance of forms exhibiting it.
8. Mimicry cannot be explained by relationship or by parallel variation.
9. Among butterflies mimicry is much commoner in the female sex : this harmonises with the greater variability of that sex.
10. Mimics inhabit the same localities as the models but the likeness cannot be explained by the influence of food or enviroment.
11. The purely accidental resemblances between insects inhabiting widely separated localities fall far behind mimetic resemblance in pefection of detail. Such accidental resemblances are very crude and lacking in the perfection of mimicry.
12. Just as there is polymorphism in a species resembling dead leaves, so there is often polymorphism in a mimetic species. In the former case the species gains because dead leaves are of many different appearances, and the greater the variety of leaves resembled the more chance is there of a form resembling one particular variety surviving to reproduce its kind. Benefit accrues to the species by the increased amount of work that has to be done by the enemy because, in order to find an edible morsel, it must examine a larger number of apparent dead leaves of different appearances than if it had only to search through numbers of leaves of one appearance.

    In the second case the species gains by resembling a number of different models because these will have different habitats, and a mimetic species able to live in more than one environment will find protection in each from the particular species of model living there.
13. A species mimicking another in one locality may mimic quite a different model in a second locality, although the first model may also occur in the second locality.

12. **Bactria entebbensis** sp.nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 171.

A dark species superficially resembling *B. fasciata*, but larger and with the anterior four tibiae partially of a dull brownish colour. Differs also in the following characters :—

♂. Length of body 22-4 mm., of wing 17-18 mm.

♂. *Head.* Lateralia with all the hairs and bristles yellow. Greatest width of eye about one-and-three-quarter times the width of face at narrowest point. Palps with black and yellow bristles intermixed.

Legs. Anterior femora with one or two bristles on the posterior surface; length of posterior femora about four times the dorso-ventral diameter. Posterior femora with a postero-ventral group of about twenty stout spines near base and with a row of about four spines extending towards the posterior surface; ventral row of spines not present. Posterior tibiae with a distal pad of spines of which the terminal spine is longer and forms a small, but distinct, tooth-like claw. The four anterior tibiae with the posterior and adjacent surfaces yellowish-brown.

Abdomen. The first tergite with a band of white hairs, the fourth and succeeding tergites with nearly all the bristles black. The first three sternites with long yellow hairs, the three following sternites with short yellow bristles and the seventh with most of the bristles short and black. The eighth sternite densely clothed with short black bristles, strongly convex and with the distal margin almost semi-circular. Upper forceps (ninth tergite) about three times as long as greatest breadth and with the tips not curved inwards; each limb with a *small* extension on the posterior margin near the base of the anal (tenth) segment. Ninth sternite entire, about one-and-three-quarter times as broad as long. Aedeagus without dorsal or ventral lobes, slightly expanded shortly before the apex (Figs. 14 and 39).

♀. Specimens which I place provisionally as females of this species resemble the males, but have the tibiae and mystax darker.

Holotype, ♂, UGANDA, Entebbe, about 3800 feet, from grazing land on lake shore, 31.v.1909 (*C. A. Wiggins*, Hope Dept.). *Paratypes*: UGANDA: — 1 ♂, Entebbe, from forest, lake shore, east of Kitabi Hill, 22.vi.1912 (*C. A. Wiggins*, Hope Dept.); 1 ♂, Entebbe, 14.xi.1912 (*C. C. Gowdey*, Brit. Mus.). *Females* (*not to be considered as paratypes*): UGANDA : — 2 ♀♀, Entebbe, 3.ix.1912 and 16.x.1912; 1 ♀, Tero, 14.iv.1911 (*C. C. Gowdey*, Brit. Mus.).

13. **Bactria crassifemorata** sp. nov.

Allied to *B. entebbensis*, from which it is distinguished by the following characters :—

♂. Length of body 24 mm., of wing 17 mm.

♂. *Legs.* Anterior femora without bristles on postero-dorsal surface. Length of posterior femora nearly three-and-a-half times the dorso-ventral diameter. Posterior femora with the basal group and oblique rows composed of

rather long and stout spines, the oblique row consisting of about five spines partially present in duplicate; the ventral row composed of weaker spines, some of which are present in duplicate and all of which, except a few near the base, are yellow.

Abdomen. The first tergite with yellow and white hairs intermixed, at the sides with some of the hairs black. The second and third tergites at the sides with the hairs yellow; the fourth tergite at the sides with yellow bristles; the remaining tergites with the bristles black. Eighth sternite somewhat truncate. Aedeagus with distal part sub-cylindrical as viewed from above (Figs. 15 and 40).

Holotype:—♂, CAMEROONS, Duala, 22.x. (*v. Rothkirch*, Deutsch. Inst.).

14. **Bactria carpenteri** sp. nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 171.

Closely related to *B. crassifemorata* from which it differs in the following characters:—

♂. Length of body 19-22 mm., of wing 15-17 mm.

♂. *Head.* Mystax above and at the sides with the bristles black, lateralia with most of the bristles and hairs black.

Legs. Posterior femora less stout, posterior tibiae more strongly curved. Posterior femora with the ventral row of spines either entirely black or with only the distal spines yellow.

Abdomen. Above, the first segment with a band of white hairs, at the sides usually with a few of the hairs yellow and others which are black; the second and third segments at the sides without, or with very few, yellow hairs. Upper forceps (ninth tergite) a little shorter and broader. Ninth sternite about twice as broad as long, the distal margin with a weakly chitinised median area. Aedeagus with the distal part shorter and stouter (Figs. 16 and 41).

♀. Specimens which I place provisionally as females of this species closely resemble the males, but tend to have yellow hairs on the second and third abdominal segments.

Holotype:—♂, UGANDA, L. Victoria, Sese Islands, Bugalla Island, in forest by lake shore where *Glossina palpalis* abounds, iii.1912 (*G. D. H. Carpenter*, Brit. Mus.). *Paratypes*: UGANDA:—1 ♂, Tero, 14.iv.1911; 1 ♂, Kampala, 13.vii.1911; 2 ♂♂, Entebbe, 3.ix.1912 (*C. C. Gowdey*, Brit. Mus.). 1 ♂, Entebbe, 1-11.ix.1911 (*S. A. Neave*, Brit. Mus.). 2 ♂♂, Bugalla Island, iii.1912 (*G. D. H. Carpenter*, Brit. Mus.). 1 ♂, 17.vi.1912; 1 ♂, 19.vi.1912; 1 ♂, 20.vi.1912; 2 ♂♂, 24.vi.1912; Entebbe, all about 3800 ft. in forest N.E. of Kitabi Hill (*C. A. Wiggins*, Hope Dept.). 1 ♂, Entebbe, 1-14.ix.1912 (*C. A. Wiggins*, Brit. Mus.). TANGANYIKA:—1 ♂, 'Urwald Beni,' ix.1910 (*Grauer*, Vienna Mus.). 1 ♂, Mawembi-Ukaika, xi-xii.1910 (*Grauer*, Vienna Mus.). *Females* (*not to be considered as paratypes*): UGANDA:—1 ♀, iii.1912; 2 ♀♀, viii.1912 (*G. D. H. Carpenter*, Brit. Mus.).

15. **Bactria venatrix** sp. nov.

Superficially not unlike *B. aequalis* Loew, but closely related to *B. carpenteri* from which it differs in the following characters :—

♂ ♀. Length of body 18-20 mm., of wing 14-15 mm.

♂. *Head.* Mystax, lateralia and palps with hairs and bristles yellow. Most of the occipital bristles yellow, a few of the bristles black.

Thorax. Mesonotum with pruinescence yellowish-brown and traces of a striped pattern. Scutellum with black hairs and both yellow and black bristles.

Legs. Black except the tibiae, which may be more or less extensively dull reddish-brown. Posterior femora stouter and with simple ventral and oblique rows of well developed spines. Posterior tibiae not so strongly curved.

Wings. Veins reddish-brown, costa with yellow bristles at the base.

Abdomen. Tergites with pruinescence at the sides yellowish; first segment with the hairs white except at the sides, where they are yellow; fourth and fifth segments at the sides with a few yellow bristles, the remaining bristles black. The first six sternites with yellow pruinescence and long yellow hairs; the seventh sternite with black bristles distally. Aedeagus with distal part longer; basal part with ventral lobe weakly represented (Fig. 17).

♀. Resembles the male.

Holotype : — ♂, KENYA, Nairobi, 1915 (*A. Loveridge*, Brit. Mus.). *Allotype*, ♀, and *paratype*, ♂ : KENYA, Nairobi, Ngong, 29.x.1919 (*A. Loveridge*, Brit. Mus.).

16. **Bactria promiscua** sp. nov.

Resembles *B. mixta* from which it differs in the following characters :—

♂. Length of body 8 mm., of wing 16 mm.

♂. *Head.* Palps with nearly all the bristles above and the distal bristles below black, the basi-ventral bristles yellow. Occiput with black and yellow bristles intermixed.

Thorax. Mesonotum with all the hairs black except for a few on the post-alar calli, which are yellow. Scutellum with a few black hairs intermixed with the yellow bristles and hairs.

Legs. Anterior femora with two posterior bristles. Posterior femora with the basal group and the oblique rows of spines black, the ventral row of spines yellow. Posterior femora much thicker, length about three-and-two-thirds the dorso-ventral diameter. Posterior tibiae strongly curved.

Abdomen. Fourth tergite on the disc with both white and yellow bristles. Aedeagus not unlike that of *B. mixta,* but with distal part distinctly sinuate as viewed from the side, and pear-shaped as viewed from above (Figs. 18 and 42).

Holotype :—♂, BELGIAN CONGO, Komi, Sankuru, 8.iv.1930 (*J. Ghesquière*, Mus. Congo).

17. **Bactria wollastoni** sp. nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, 5: 171.

Superficially resembles *B. aequalis* from which it differs in the following characters :—

♂ ♀. Length of body 17-20 mm., of wing 13-22 mm.

♂. *Thorax.* Mesonotum with stripes less distinct. Scutellum with the hairs yellow, the bristles black and yellow intermixed or all yellow.

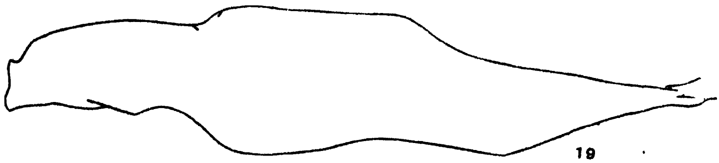
Legs. Posterior femora with an oblique row of about four spines extending distally from the postero-ventral group of spines towards the posterior surface.

Wings. Costa with all or nearly all the bristles black.

Abdomen. First segment with a narrow band of hairs which are white on the disc and yellow at the sides. Eighth sternite more rounded. Upper forceps (ninth tergite) stouter, each limb with a *small* extension on the posterior margin near the base of the anal (tenth) segment. Anal segment more elongate. Aedeagus almost parallel-sided in lateral view, distal part on each side with a very small triangular process basi-ventrally (Fig. 19).

♀. Closely resembles the male.

Holotype, ♂, and *allotype*, ♀, UGANDA, E. Ruwenzori, 5,000-7,000 ft., 2.i.1906 and 26.i.1906 (*G. Legge* and *A. F. R. Wollaston*, Brit. Mus.). *Paratypes*: KENYA:—1 ♂, v.1913; 1 ♀, 1912: both Mogorr River (*A. O. Luckman*, Brit. Mus.).



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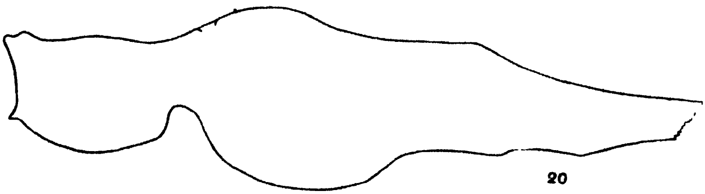

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FIGS. 19 and 20.—Aedeagus, lateral view. 19, *wollastoni* sp. nov.; 20, *cornuta* sp. nov.

18. **Bactria cornuta** sp. nov.

Allied to *B. wollastoni* from which it differs in the following characters:—

♂. Length of body 20 mm., of wing 17 mm.

♂. *Thorax.* Without distinct stripes. Scutellum with all the bristles and hairs yellow.

Legs. Posterior femora stouter, posterior tibiae more strongly curved.

Abdomen. First segment with a band of yellow hairs. The fourth and following segments with the yellow bristles at the sides more numerous. Upper forceps (ninth tergite) more elongate, but only extending as far as the anal (tenth tergite) segment. Aedeagus not parallel-sided, basal part with ventral lobe, distal part very broad dorso-ventrally (Fig. 20).

Holotype: ♂, without data, possibly from UGANDA (Brit. Mus.).

19. **Bactria erythrosceles** sp. nov.

A very distinct species with reddish-brown femora and tibiae, and pitchy tarsi.

♂. Length of body 20-21 mm., of wing 14-15 mm.

♂. *Head.* Mystax, lateralia and beard with bristles and hairs yellow; all or nearly all the occipital bristles yellow. Palps above and distally with the bristles black, below with the bristles yellow. Frons with most of the hairs black. Basal antennal segments with both black and yellow bristles. Greatest width of eye about one-and-four-fifths times the width of face at narrowest point. Facial hump not quite as well developed as that of *B. aequalis*.

Thorax. Pronotum with yellow hairs and a row of yellow bristles. Mesonotum similar to that of *B. aequalis.* Scutellum with hairs and bristles black.

Legs. Coxae black; trochanters warm reddish-brown narrowly bordered with black; femora chiefly warm reddish-brown, the knees partly black, the anterior surfaces of the anterior femora sometimes partly blackish; tibiae warm reddish-brown; tarsi pitchy; claws black except at the base, where they are reddish-brown. Anterior femora with or without a postero-dorsal bristle. Length of posterior femora about four times the dorso-ventral diameter, about one-and-a-third times as long as the posterior tibiae. Basal third of posterior femora with a slight general postero-ventral swelling bearing a group of spines of which those nearer the anterior surface are long. Ventral surface with a row of about seven short spines, a second row of about six longer spines running almost parallel with first, but slightly diverging distally towards the postero-ventral surface, and a more posterior third row of about four long spines. Posterior tibiae distinctly curved, slightly shorter than the posterior tarsal segments together; disto-ventral pad of spines hidden beneath the hairs, the terminal spine stouter and forming a *short* tooth-like claw.

Wings. Very similar to those of *B. aequalis.*

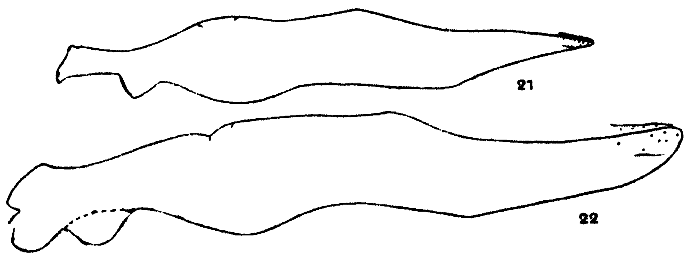
Abdomen. Black above; the first seven tergites at the sides with a broad band of yellowish-grey pruinescence which tends to extend inwards along the hind margins of the segments; the first three segments with bands of white hairs; the four following segments with short yellow bristles at the sides and black ones on the disc; the remaining segments shining black with black bristles. Ventral surface black; the first seven segments with yellowish-grey pruinescence, the hairs white, yellow or black. The eighth sternite truncate, shining black with black bristles. Upper forceps (ninth tergite) extending beyond anal (tenth) segment about two-and-a-half times as long as broad, the tips not bent inwards. Ninth sternite with a weakly chitinised median area in the distal margin. The distal part of the aedeagus with a small latero-ventral equilateral triangular process on each side (Figs. 21 and 43).

♀. A specimen which I place provisionally as the female of this species closely resembles the male, but differs in having some of the pronotal bristles black, the scutellar bristles yellow, the scutellar hairs white and the tarsi black.

Holotype, ♂, and *paratype*, ♂, BELGIAN CONGO, Haut Uelé, Yebo Moto (1926 and 1924 respectively) (*L. Burgeon*, Mus. Congo). *Female* (*not to be considered as a paratype*), UGANDA, Wakolis,

about 30 miles north of Lake Victoria, 3,600 ft., among elephant grass, 4.iv.1906 (*C. A. Wiggins*, Hope Dept.).

Note.—A headless female from Sierra Leone, Firiwa, 9.vi.1912 (*J. J. Simpson*, Brit. Mus.) closely resembles *B. erythrosceles*, but I believe it to be distinct. A small male from Sierra Leone (*D. F. Morgan*, Brit. Mus.) also resembles *B. erythrosceles*, but differs in the arrangement of bristles on the posterior femora. Since the terminal abdominal segments are missing it is unwise to describe it as new, although it is probably distinct. It was erroneously referred to *B. fasciata* by Ricardo (1920, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 172).



Figs. 21 and 22.—Aedeagus, lateral view. 21, *erythrosceles* sp. nov.; 22, *rufotibialis* sp. nov.

20. **Bactria rufotibialis** sp. nov.

Resembles *B. erythrosceles* in having reddish-brown tibiae, but differs from this species in having the femora black and in the following characters :—

♂. Length of body 19 mm., of wing 13 mm.

♂. *Head.* Palps with all the hairs yellow.

Thorax. Mesonotum with nearly all the hairs black.

Legs. Trochanters chiefly black; femora with only a trace of reddish-brown distally, tarsi blackish. Anterior femora without postero-dorsal bristles. Posterior femora with a basal group of spines, a ventral row of about four short spines and an oblique row of about five longer spines. Posterior tibiae scarcely curved, a little longer than the posterior tarsal segments together, the distal *third* covered with a ventral pad of spines.

Abdomen. Pruinescence at the sides and, less distinctly, along the hind margins of the tergites grey. Bristles at the sides of the fourth to seventh tergites white; the first seven sternites with white hairs. Aedeagus expanded at the tip, on each side with a broad but thin and rather transparent flange distally, without dorsal or ventral lobes (Figs. 22 and 44).

Holotype : ♂, Africa, from an old collection (Vienna Mus.).

Note.—A female from Abyssinia, xi.1911 (*R. J. Stordy*, Brit. Mus.) superficially resembles *B. rufotibialis*, but I believe it to be distinct.

21. **Bactria versicolor** sp. nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 171.

Resembles *B. erythrosceles*, but differs in having the femora partly or entirely black and in the following characters:—

♂ ♀. Length of body 18-21 mm., of wing 12-17 mm.

♂. *Head.* Anteriorly the frons usually with yellow hairs, posteriorly with black hairs. Palps with yellow bristles.

Thorax. Scutellum with most or all the bristles black, often a few of the bristles yellowish, hairs white.

Legs. In the holotype the trochanters and extreme base of femora brownish; the basal two-thirds of the femora chiefly black, the distal third testaceous except the knees which are partially black; tibiae testaceous; tarsi darker. In other specimens the testaceous colour is less extensive and the trochanters and femora may be entirely black. Femora and tibiae with nearly all the hairs yellow except on the anterior femora where nearly all the hairs are black. Anterior femora without postero-dorsal bristles. Length of posterior femora about four-and-a-half times its dorso-ventral diameter. Posterior femora with a sparse group of long spines near the base, a row of long spines on the ventral surface and a similar row extending towards the posterior surface; sometimes the spines, especially the ventral row, much reduced in number. Posterior tibiae not as distinctly curved as those of *B. erythrosceles*, slightly longer than the posterior tarsal segments together.

Abdomen. Very similar to that of *B. erythrosceles*, but pruinescence at the sides more yellowish, and the bristles at the hind margins of the segments on the eighth sternite sometimes yellow, the first seven sternites with all the hairs and bristles yellow. Ninth sternite entire. Aedeagus with the apex subtriangular as viewed from above; basal part with a strong ventro-distal lobe (Figs. 13 and 46).

♀. The allotype female closely resembles the holotype. A second female differs in having the abdominal pruinescence grey and the femora less broadly brownish distally.

Holotype:—♂, N.E. Rhodesia, mouth of the Chambezi to Mansya R. and L. Young, 4,500 ft., 31.x.-2.xi.1908 (*S. A. Neave*, Hope Dept.). *Allotype*:—♀, Belgian Congo, S.E. Katanga, 4,000 ft., 24.xi.1907 (*S. A. Neave*, Brit. Mus.). *Paratypes*:—Rhodesia, 1 ♂, mouth of the Chambezi to Mansya R. and L. Young, 4,500 ft., 4.xi.1908 (*S. A. Neave*, Hope Dept.). Belgian Congo:—2 ♂♂, Kapiri, x.1912, labelled 'Miss. Agric.' (Mus. Congo); 1 ♂, 1 ♀, Lomami, Kishinde, ix.1931 (*P. Quarre*, Mus. Congo). 1 ♀, Kinshassa, Waelbroeck (Brussels Mus.).

22. **Bactria hastata** sp. nov.

1920. ?*Promachus xanthotrichus* Ricardo (*partim*), *nec* Bezzi, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 180.

Allied to *B. versicolor* from which it differs in the following characters:—

♂ ♀. Length of body 17-21 mm., of wing 12-16 mm.

♂. *Head.* Frons with black hairs. Occiput with black bristles.

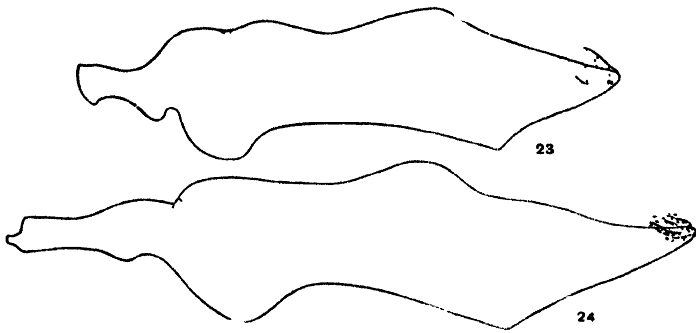
Thorax. Pronotum with black bristles. Scutellum usually with all the bristles and hairs black, occasionally some of them yellow.

Legs. Black. Posterior femora with the postero-ventral group of spines not situate so near the base, the spines rather long and more numerous. The ventral row consisting of about four to seven short spines, the oblique row consisting of about four rather long spines.

Wings. Cell R_5 narrowed and sometimes closed.

Abdomen. First tergite with the hairs usually yellowish; fourth, fifth, sixth, and seventh tergites with most of the bristles yellow. Eighth sternite produced, truncate apically where it bears a transverse row of long bristles. Aedeagus not unlike *B. versicolor*, but more elongate; the distal part, as viewed from above, broadest shortly before the middle; basal part with a very strongly developed ventral lobe (Figs. 24 and 47).

♀. Resembles the male.



FIGS. 23 and 24.—Aedeagus, lateral view. 23, *versicolor* sp. nov.; 24, *hastata* sp. nov.

Holotype:—♂, BELGIAN CONGO, Nyangwe, iv.-v.1918 (*R. Mayné*, Mus. Congo). *Allotype*:—♀, BELGIAN CONGO, Lomami, Kisamba (*P. Quarre*, Mus. Congo). *Paratypes*: BELGIAN CONGO:—1 ♂, with *Glossina palpalis* Desv., ♂, as prey, Lomami, 1931; 1 ♂, xii.1930, and 1 ♀, xii.1931, Lomami, Lusuku; 1 ♂, Lomami, Kisamba (all *P. Quarre*, Mus. Congo). 1 ♂, Sandoa, 24.xi.1918 (*F. G. Overlaet*, Mus. Congo). TANGANYIKA:—3 ♂♂, labelled 'Urw. hint d. Randbg. d. N.W. Tanganyika. S. 18-2200 m.'; 1 ♂, N.W. Tanganyika, 1910 (*Grauer*, Vienna Mus.).

Note.—In addition to the above I have seen the following four specimens which may belong to this species. (1) 1 ♀, PORTUGUESE CONGO, San Salvador, 1909 (*M. Gamble*, Brit. Mus.). Differs from type in having all the occipital and scutellar bristles yellow. Cell R_5 is closed. This is the specimen referred to *Promachus xanthotrichus* by Ricardo (1920). (2) 1 ♀, BELGIAN CONGO, Nyangwe, iv.-v.1918 (*R. Mayné*, Mus. Congo). This specimen has the three

segments of the abdomen with yellow hairs. Scutellum and occiput with both yellow and black bristles. Cell R_5 is open. (3) 1 ♀, BELGIAN CONGO, Lukugar, Niemba, xi.1917-i.1918 (*Dr. Pons*, Mus. Congo). Resembles the second of the above described specimens. (4) 1 ♀, BELGIAN CONGO, Nyangwe, 29.xi.1910 (*Dr. J. Bequaert*, Mus. Congo). Resembles the second and third of the above described specimens, but has all the scutellar bristles yellow. Cell R_5 is just closed.

23. **Bactria calcarata** sp. nov.

1920. *Promachus fasciatus* Ricardo (*partim*), nec Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 171.

A small species distinguished by the long spur on the posterior tibiae of the male and by the lateral wing-like processes of the aedeagus. (Described from a teneral specimen.)

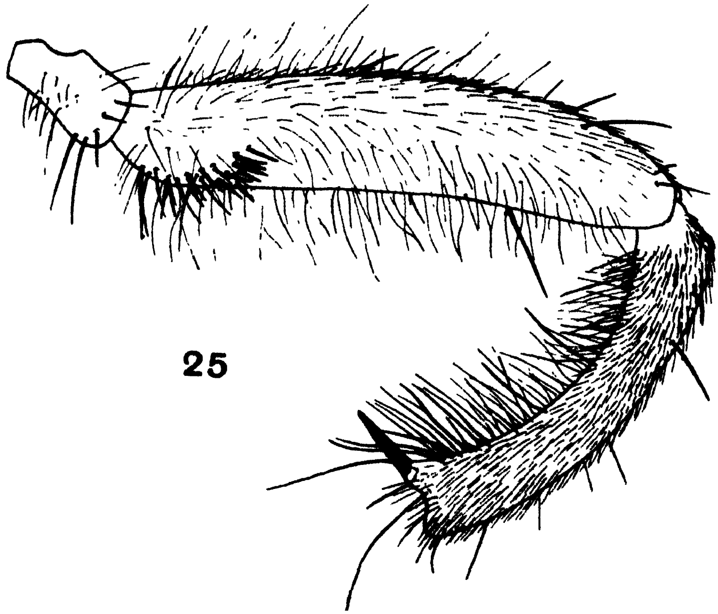


FIG. 25.—*calcarata* sp. nov.; trochanter, femora and tibia of posterior leg.

♂. Length of body 14 mm., of wing 11 mm.

♂. *Head.* Mystax mainly pale yellow, a few of the outer bristles black; lateralia with the hairs black. Greatest width of eye about 1.7 times the width of face at narrowest point. Basal antennal segments with both black and yellow hairs.

Thorax. Pronotum with only four fine black bristles. Mesonotum blackish, the sides more brownish; in front with a narrow median longitudinal reddish-brown stripe; pruinescence sparse and not distinct; humeral and post-alar calli with a few pale hairs. Scutellum brownish, some of the hairs and bristles black, others whitish-yellow.

Legs. Brownish-black. Length of posterior femora about four-and-three-quarter times the dorso-ventral diameter, about one-and-a-half times as long as the tibia. Posterior femora with a compact group of postero-ventral spines near the base, but without ventral or postero-ventral rows of similar spines. Posterior tibiae strongly curved, slightly shorter than the posterior tarsi together; distally with a long ventral spur (Fig. 25) instead of a pad of very short spines such as is found in *B. fasciata*.

Abdomen. Blackish; pruinescence below, and above at the sides, greyish; the first tergite with yelllowish-white hairs, the fourth and following segments with all the bristles black; the anterior sternites with long whitish hairs; the fourth, fifth, and sixth sternites with short yellow hairs, the remaining segments with black hairs and bristles. Upper forceps (ninth tergite) not extending beyond anal (tenth) segment, about twice as long as broad and inclined at an angle so as to form a roof-like cover to the terminal abdominal structures; each forcep with a *small* extension on the posterior margin near the base of the anal segment. Ninth sternite entire. Aedeagus with an elongate, isosceles, wing-like process, standing out at right angles to the longitudinal axis, near the base of the long narrow distal piece; the right and left halves of the distal piece slightly divergent and turned downwards at the extreme tip (Fig. 45).

Holotype:—♂, ASHANTI, Obuasi, caught on leaf in bush, 10 a.m., 27.ix.1907 (*W. M. Graham*, Brit. Mus.).

24. **Bactria zenkeri** sp. nov.

A robust species superficially resembling *B. mediospinosa*, but having the spines on the hind femora of the male situate near the base as in *B. fasciata* from which it differs in the following characters:—

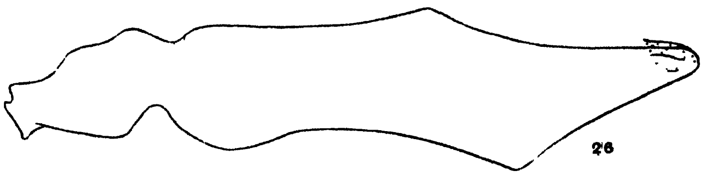

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FIG. 26.—*zenkeri* sp. nov.; aedeagus, lateral view.

♂. Length of body 24 mm., of wing 17 mm.

♂. *Head.* Mystax yellow, outer bristles black; lateralia with black bristles and a few yellow hairs. Greatest width of eye about one-and-three-quarter times the width of face at narrowest point. Facial hump very strongly developed. Basal antennal segment with both black and yellow hairs.

Thorax. Mesonotum and scutellum with all the bristles and hairs black.

Legs. Anterior femora with one or two bristles on the postero-dorsal surface; length of posterior femora about 3.8 times the dorsal-ventral diameter. Posterior femora with the basal swelling more distinct; most of the spines strongly developed, the ventral row consisting of about eight weaker spines, the oblique row partially duplicated basally. Anterior and middle tibiae with the posterior surfaces obscurely dull blackish-brown, the posterior tibiae with a pad of ventral spines of which one forms a *short* terminal tooth-like claw.

Abdomen. The first three tergites with bands of white hairs, the following segments with hairs and bristles black. Eighth sternite densely covered with

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long black hairs. Upper forceps (ninth tergite) long, but without the tips curving inwards towards one another. Basal part of aedeagus with a small ventral lobe, apex ovate as viewed from above (Figs. 26 and 48).

Holotype: — ♂, CAMEROONS, Bipindi, x.-xii.1896 (*G. Zenker*, Berlin Mus.).

25. *Bactria mediospinosa* Speiser.

1913. *Promachus mediospinosus* Speiser, *Deutsch. Ent. Zeit.*, **1913**: 141-2.

1920. *Promachus mediospinosus* Ricardo, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 170.

The type of a section of four closely allied species which agree in having a *median* postero-ventral group of spines on the posterior femora of the males. The species are best distinguished by the structure of the aedeagus.

♂ ♀. Length of body 23-27.5 mm., of wing 16-18 mm.

♂. *Head.* Mystax usually wholly golden-yellow; lateralia with the bristles black or yellow or with both intermixed. Palps dorsally and distally with black bristles, baso-ventrally with yellow bristles; sometimes with all the basal bristles yellow and in extreme forms with all of them yellow. Beard golden-yellow. Occiput with the bristles black or yellow or with both intermixed. Frons with black hairs, in extreme forms with black and yellow hairs intermixed. Third antennal segment a little longer than the basal segment.

Thorax. Mesonotum black with brownish pruinescence at the sides, but without distinct medio-dorsal and latero-dorsal stripes. Hairs black except for a few yellow ones anteriorly and above the wing bases. Scutellar bristles and hairs black and yellow intermixed, in some forms almost wholly yellow, in others with a few white hairs among the black and yellow ones.

Legs. Almost entirely black, the middle tibiae with dorsal and posterior surfaces dull brownish, the anterior and posterior tibiae sometimes with a trace of very dull brownish colour on the dorsal or posterior surfaces. Some of the hairs black, the remainder golden-yellow. Posterior femora about three-and-a-half times as long as the dorso-ventral diameter, about one-and-a-half times as long as the tibiae; posterior tibiae swollen distally, slightly curved, a little shorter than the tarsi. Anterior femora with one to three postero-dorsal bristles; posterior femora with a slight postero-ventral *median* swelling bearing a group of spines from which there extends a distal and basal row of similar spines along the ventral surface and an oblique row of two to four spines dorsally and distally towards the posterior surface; posterior tibiae with a ventro-distal pad of short spines.

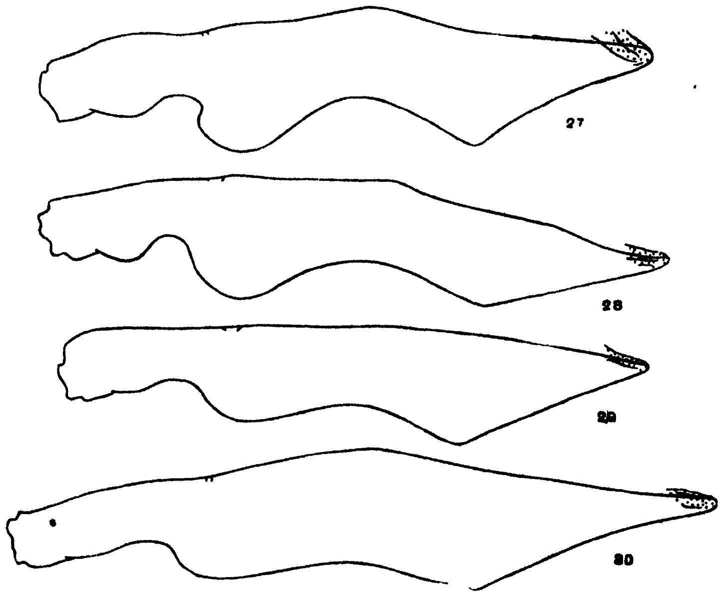
Wings. Smoky, costa with yellow bristles at the base.

Abdomen. Dorsal surface black, at the sides with brownish or yellowish-brown pruinescence. The first segment with a narrow band of yellow hairs, sometimes with a few white hairs; the second and third segments with yellow hairs at the sides and transverse tufts of white hairs on the disc; the four following segments with a band of yellow bristles and hairs at the sides and black bristles on the disc; the eighth segment usually with black bristles and hairs, sometimes with yellow ones; the remaining segments with black bristles and hairs. Ventral surface black; the first seven segments with yellowish-brown pruinescence and golden-yellow hairs and bristles; the eighth sternite truncate, shining black with black hairs and bristles, sometimes with a few

yellow ones. Upper forceps (ninth tergite) extending beyond anal (tenth) segment, about two and two-thirds as long as broad; each forcep with a *small* extension on the posterior margin near the base of the anal (tenth) segment. Ninth sternite with a weakly chitinised median area in the distal margin. Aedeagus rather broad and obliquely truncate at the base; distal part short, on each side with a broad lateral flange so that the apex appears broadly pear-shaped as viewed from above; ventral lobe prominent (Figs. 27 and 50.)

♀. Closely resembles the male.

Specimens seen: CAMEROONS: — ♂ holotype, ♀ allotype and 1 ♂ paratype, Duala, x.1913 (*v. Rothkirch, in coll. Dr. P. Speiser*); 1 ♂, Longji (*H. Pasdien,* Berlin Mus.). NIGERIA, 2 ♂♂, Ibadan, Moor Plantation, 12.x.1913 (*W. A. Lamborn,* Hope Dept.).



FIGS. 27—30.—Aedeagus, lateral view. 27, *mediospinosa* Speiser; 28, *speiseri* sp. nov.; 29, *mesacantha* sp. nov.; 30, *mesorrhachis* sp. nov.

26. **Bactria speiseri** sp. nov.

Closely resembles *B. mediospinosa,* but is a little smaller and the yellow bristles and hairs are not so bright. The specimens examined differ also in the following characters:—

♂. Length of body 20-24 mm., of wing 14-16 mm.

♂. *Head.* Mystax with a number of black bristles above and at the sides. Hairs and bristles on the lateralia, palpal bristles (with the exception of a few at the base), the row of occipital bristles, the occipital hairs above this row, and the hairs on the frons black.

Thorax. Scutellar bristles black, the scutellar hairs black and white intermixed.

Legs. Black except for a trace of dull brownish colour on the middle tibiae in some of the specimens.

Abdomen. The first tergite with the hairs entirely white except for a few at the sides which may be yellowish or black; the second and third tergites with the transverse tufts of hair entirely white; the four following segments with nearly all the bristles and hairs black. Ventral surface with some of the hairs black, the remainder white or yellow. Aedeagus with the apex, as viewed from above, not so broadly pear-shaped, basal part narrower, ventral lobe more evenly rounded and less prominent (Figs. 28 and 49).

Holotype :—♂, NIGERIA, Johann-Albrechshöhe, 14.vii.-17.viii. 1896 (*L. Conradt,* Zool. Mus., Berlin). *Paratypes* : — NIGERIA, 1 ♂, Johann-Albrechshöhe, 17.ii.1896 (*L. Conradt*); 1 ♂, Barombi-Stat. (*Preuss*); (Zool. Mus., Berlin). 1 ♂, Barombi (*Lichtwardt*); 2 ♂♂ labelled Kamarun (*L. Conradt*) (Deut. Inst., Berlin).

27. **Bactria mesacantha** sp. nov.

♂. Length of body 16-23 mm., of wing 13-16 mm.

♂. Very closely resembles *B. speiseri*, but differs in having the aedeagus with the latero-distal flange smaller, the apex more uniform in width as viewed from above, the ventral lobe less pronounced and the ninth sternite shorter (Figs. 29 and 51).

Holotype: — NIGERIA, Victoria, vii.1916-viii.1917 (*F. H. Fitz-Roy,* Brit. Mus.). *Paratype* :—LIBERIA, 1 ♂, Ghanga, ix.1926 (*J. Bequaert,* Mus. Congo).

(*To be continued.*)

THE ETHIOPIAN SPECIES OF THE *FASCIATA* GROUP OF THE GENUS *BACTRIA* (= *PROMACHUS*) (DIPTERA, ASILIDAE).

BY B. M. HOBBY, M.A., D.PHIL., F.R.E.S., M.S.B.E.
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(*Concluded from p.* 249.)

28. **Bactria mesorrhachis** sp. nov.

1920. *Promachus fasciatus* Ricardo (*partim*), *nec* Fabricius, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 172.

Closely resembles *B. mesacantha,* but distinguished by the longer distal part of the aedeagus and, in the specimens examined, by the following characters :—

♂. Length of body 24-26 mm., of wing 16-18 mm.

♂. *Head.* Mystax usually with a number of black bristles above and on the lateralia, sometimes nearly all the bristles yellow.

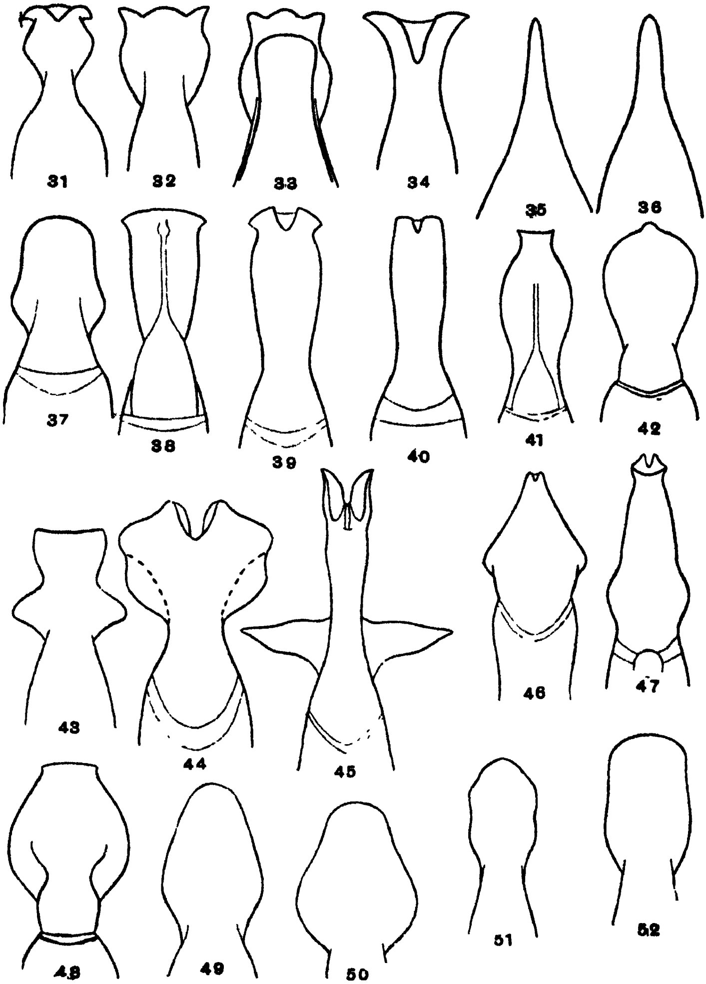
Thorax. Scutellum usually with all the bristles and hairs black, although in the two specimens from Ashanti a few of the hairs are yellow.

Abdomen. The first segment without or with comparatively few white hairs, usually with a large proportion of the hairs black, the remainder mainly yellowish; in the two specimens from Ashanti, however, all the hairs are yellow. These two specimens also have the hairs and bristles at the sides of the first seven tergites yellow, but in specimens from Sierra Leone these segments have many or nearly all of the hairs and bristles black. Aedeagus with distal part longer than that of *B. mediospinosa, B. speiseri* and *B. mesacantha,* latero-distal flange small as in *B. mesacantha* and the apex almost parallel sided as viewed from above; ventral lobe not unlike that of *B. mediospinosa,* but less prominent (Figs. 30 and 52).

♀. Resembles the male. Distinguished from the female of *B. fasciata* by the absence of latero-distal tufts of bristles on the eighth abdominal tergite.

Holotype, ♂, and *allotype,* ♀, SIERRA LEONE, Freetown, 14.ix. 1899 and 21.ix. 1899 respectively (*E. E. Austen*). *Paratypes* :— SIERRA LEONE, 1 ♂, Freetown, 15.ix.1899 (*E. E. Austen*). 4 ♂♂ (*W. G. Clements*). 2 ♂♂, 1 ♀, Jarra, 9.ix.1912; 1 ♂, Jowati, 19.viii.1912; 1 ♂, Sembehun, 30.viii.1912; 1 ♂, Kamboma, 11.ix. 1912 (*J. J. Simpson*). 1 ♂ (Hope Dept.). ASHANTI :— 1 ♂, Kumasi, 21.x.1907, 'caught in bush on leaf' (*W. M. Graham*). 1 ♂ (Hope Dept.).

Unless otherwise stated, all the above are in the British Museum.



Figs. 31—52.—Aedeagus, dorsal view of apex. 31, *fasciata* F. (*floccosa* Kirby, *xanthotricha* Bezzi and *niveicincta* sp. nov. are of the same type); 32, *aequalis* Loew; 33, *gossypiata* Speiser; 34, *trichozona* Loew; 35, *acuminata* sp. nov.; 36, *conradti* sp. nov.; 37, *neavei* sp. nov.; 38, *mixta* sp. nov.; 39, *entebbensis* sp. nov.; 40, *crassifemorata* sp. nov.; 41, *carpenteri* sp. nov.; 42, *promiscua* sp. nov.; 43, *erythrosceles* sp. nov.; 44, *rufotibialis* sp. nov.; 45, *calcarata* sp. nov.; 46, *versicolor* sp. nov.; 47, *hastata* sp. nov.; 48, *zenkeri* sp. nov.; 49, *speiseri* sp. nov.; 50, *mediospinosa* Speiser; 51, *mesacantha* sp. nov.; 52, *mesorrachis* sp. nov.

Species Incertae.

29. *Bactria caffra* Macquart.

1846. *Trupanea caffra* Macquart, Dipt. exot., Suppl. **1**: 79. 40.
1855. *Trupanea caffra* Walker, List Dipt. Brit. Mus., Part 7, Suppl. 3: 596.37.
1860. *Promachus caffer* Loew, Dipt. Fauna Süd-afrika's, **1**: 127.17.
1910. *Promachus caffer* Speiser, Kilimandjaro Meru Exp., **10** (4): 96.

Original Description.

'*Nigra. Abdomine basi albo piloso. Mystace flavo. Antennis pedibusque nigris. Alis flavidis.* Long. 10 l. ♂. Voisin du *T. trichonotus.* Wied. Palpes noirs, à poils noirs. Barbe, face et moustache jaunes. Front noir, à léger duvet jaunâtre. Thorax à duvet jaunâtre et bandes noires, presque contigués. Abdomen noir; les deux premiers segments à poils blancs. Pieds à soies et poils jaunâtres. Ailes un peu brunâtres au bord extérieur; première cellule sous-marginale brune, bordée de jaunâtre; nervures comme dans la *T. Flavifasciata.*

De la Cafrerie. Reçu de M. Delegorgue.'

30. *Bactria robertii* Macquart.

1838. *Trupanea robertii* Macquart, Dipt. Exot., **1** (2): 95.6.
1855. *Trupanea robertii* Walker, List Dipt. Brit. Mus., Part 7, Suppl. 3: 596.38.
1860. *Promachus robertii* Loew, Dipt.-Fauna Südafrika's, **1**: 127.7.
1910. *Promachus roberti* Speiser, Kilimandjaro Meru Exp., **10** (4): 96.
1920. *Promachus robertii* Ricardo, *Ann. Mag. Nat. Hist.*, Ser. 9, **5**: 170.

Original Description.

'*Nigra. Capite albo. Abdomine tribus segmentis anticis flavido-pilosis. Tibiis externe castaneis. Alis rufescentibus.* Long. 8 l. ♀.

Thorax (dénudé); côtés à duvet cendré. Hanches, cuisses et jambes à poils blanchâtres en-dessous. Ailes à bande longitudinale grise dans la première cellule sous-marginale. Du Sénégal. M. Robert. Muséum.'

Addendum: The Status of the Names *Telejoneura* Rondani (1863), *Erax* Scopoli (1763), and *Protophanes* (Loew (1860).

Kertész (1909, Cat. Dipt., **4**: 216) places *Telejoneura* Rondani (1863, *Arch. Zool.*, **3**: 48) in the synomony of *Promachus* Loew (1848, *Linn. Ent.*, **3**: 390), while Coquillet (1910, *Proc. U.S. Nat. Mus.*, **37**: 612) states that *Telejoneura* is a change of name for *Trupanea* Macquart (1838) Dipt. Exot., **1** (2): 91), a genus with the same genotype (*Asilus maculatus* Fabricius, 1775) as *Promachus*.

The first use of the name *Telejoneura* makes it clear, however, that it should replace *Trupanea*, not in the same sense in which it

was proposed by Macquart, but as conceived by Bigot (1857, *Ann. Soc. Ent. Fr.* (3) **5**:543). The only species mentioned by Bigot in this connection is *Erax completus* (1838), which under the prior name of *Erax rufibarbis* Macquart (1838) (*sec* J. S. Hine 1919, *Ann. Ent. Soc. Amer.*, **12**:106 and 137) becomes the genotype of *Telejoneura.*

The genotype of *Erax* Scopoli (1763, Ent. Carn.: 359) is *Erax barbatus* Scopoli (1763) by designation of Coquillet (*op. cit.*: 539).

The genotype of *Protophanes* Loew (1860, Dipt. Fauna Südafrika's, **1**: 143) is *Asilus punctatus* Meigen (1804) (*sec* Engel, 1926, in Lindner, Die Fliegen der Palaearktischen Region, Stuttgart, **24**: 88). *Asilus punctatus* Meigen (1804) is identical with *Asilus punctipennis* Meigen (1820), which was one of the three species placed in the genus *Protophanes* by Loew (*op. cit.*: 145). Although Kertész (*op. cit.*: 273) only doubtfully equated *Erax barbatus* Scopoli (1763) to *Asilus punctatus* Meigen (1820) he was certainly correct in assigning them to the same genus. *Protophanes* Loew is, therefore, a synonym of *Erax* Scopoli.

As pointed out by Hine (*op. cit.*: 103) Macquart (1838, Dipt. Exot., **1** (2): 107) in using *Erax* as a generic name deviated so much from Scopoli's original characterization that an entirely new group of species was admitted. Of these Hine designated *Erax rufibarbis* Macquart (1838) as genotype so that *Telejoneura* is a synonym of *Erax* (*sensu* Macquart) and should be deleted from the synonymy of *Promachus.*

The name *Erax* (*sensu* Macquart) continues to be used by authors in spite of the attempt made by Coquillet (*op. cit.*: 539) to substitute that of *Eicherax* Bigot (*op. cit.*: 545) with genotype *Erax simplex* Macquart (1848) by monotypy. Indeed Hine states 'It is evident therefore, that opportunity for change of generic name is presented, but no action is taken because I am satisfied to use *Erax* in Macquart's sense and thus obviate the changes which another interpretation would involve.' Independent action of this nature is strongly to be condemned while an International Commission on Zoological Nomenclature exists. If Hine's broad conception of the genus is to be followed, the American species so long known by the name of *Erax* may well be referred to *Eichoichemus* Bigot (*op. cit.*: 543) with genotype *Erax flavianalis* Macquart (1848), by monotypy. The application of the name *Erax* to species of the Palaearctic genus *Protophanes* would, however, be unfortunate and is, I believe, a sufficient reason to ask the Inter-

nation Commission to frame an Opinion adding *Protophanes* to the Official List of Generic Names.

Hope Department of Entomology,
University Museum, Oxford.
November, 1936.

20. "Life and letters of Charles Darwin," 1888, **2**, pp. 391-393.

21. "Charles Darwin and the theory of natural selection," p. 204.

22. "On the phenomena of variation and geographical distribution as illustrated by the Papilionidae of the Malayan region." Trans. Linn. Soc. Lond., 1865, **25**, pp. 1-71.

23. "On some remarkable mimetic analogies among African butterflies," Trans. Linn. Soc. Lond., 1869, **26**, pp. 497-521.

24. Third annual report on the noxious, beneficial, and other insects of the state of Missouri. Made to the State Board of Agriculture, 1871. pp. 159-175, Jefferson City, Mo.

25. "More letters of Charles Darwin," 1903, **2**, pp. 385-386.

26. "Charles Darwin and the origin of species," pp. 103-108.

27. See the following:—"Life and Letters of Charles Darwin," 1888, **3**, pp. 93-94. "The Descent of Man," Second edition, revised and augmented, 1899, pp. 325-326. "Natural Selection and Tropical Nature" (A. R. Wallace), 1895, pp. 82-86.

28. "Rambles of a naturalist on the shores and waters of the China Seas," London, 1868, p. 24.

29. Trans. Ent. Soc. Lond., 1921, p. 54.

30. "The colours of animals," p. 388.

31. Translation of the original paper in "Kosmos" (May, 1879, p. 100), in Proc. Ent. Soc. Lond., 1879, pp. 20-29.

56

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 11, vol. ii. p. 259, *September* 1938.

New and little-known False-Scorpions from the Pacific and elsewhere. (*Arachnida–Chelonethida*). By JOSEPH C. CHAMBERLIN *, Associate Entomologist, U.S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, Corvallis, Oregon.

IN the following paper I have taken the opportunity of describing some new species of false-scorpions from Fiji, Samoa, and Hawaii, together with some species intercepted in quarantine in Hawaii and New York.

* My acknowledgments are due to E. P. Mumford, of the Pacific Entomological Survey; E. H. Bryan, Jr., of the Bishop Museum; Harold Hagan, then of the Hawaiian Pineapple Growers Association of Honolulu; and Harold E. Morrison and C. F. W. Muesebeck, of the Bureau of Entomology and Plant Quarantine of the U.S. Department of Agriculture, for the privilege of studying the material upon which this report is based.

I have also added incidentally some notes on a further species from Hawaii, *Lophochernes cryptus* Chamberlin, and on the reputedly nearly cosmopolitan *Cheiridium* (*Cheiridium*) *museorum* (Leach).

Suborder DIPLOSPHYRONIDA Chamberlin.

Superfamily **NEOBISIOIDEA** Chamberlin.

Family **Neobisiidæ** Chamberlin.

Subfamily *Neobisiinæ* Chamberlin.

Pararoncus, gen. nov. (Fig. 1.)

Orthotype. *Pararoncus histrionicus*, sp. n. Japan.

Diagnosis.—Neobisiine genus close to *Roncus*, from which it differs primarily in the chætotaxy of the maxilla, etc. At present known only from the orthotype. With two weakly developed eyes; carapace longer than broad and with a distinct epistomal process; tergites with a marginal series of about 16 setæ; sternites with about 20 setæ. Tergites and sternites each with a pair of lateral discal setæ anterior to the marginal series. Apical maxillary process of coxa i. prominent, very acute, and strongly sclerotic (fig. 1 E). Apical margin of maxilla with only two setæ (fig. 1 D). Tarsus iv. with a sub-basal tactile seta. Subterminal seta forked. Galeal tubercle absent (always ?) (fig. 1 F); palm of chelicera with four or five accessory setæ. Palps (fig. 1 G) of normal form. Marginal teeth of chela numerous, close-set, and contiguous (fig. 1 A). Movable finger with prominently crested receptor venedens comprising four offset and elevated marginal teeth (figs. 1 A & B). Exteriorly opposite, but closely proximate to, the 21st and 22nd marginal teeth (exclusive of those comprising the receptor venedens) and slightly posterior to seta T is a small, lobe-like, sclerotic accessory tooth or process of unknown but possibly sensory function (figs. 1 A & C). Chætotaxy of chela as illustrated (fig. 1 A); seta SB as close to ST as to B and ISB clearly nearer to IB than to IST, otherwise essentially as in *Roncus*.

Remarks.—The lobe-like accessory tooth or sensorium of the movable finger, described above and shown in figs. 1 A & C, is unique to my knowledge. It is conceivably of only specific value. The new genus may be separated

from the others of the subfamily by means of the following key :—

1. Chætotaxy of chela of adult comprising the normal number of setæ (eight on the fixed, four on the movable finger)	2.
Chætotaxy of chela of adult comprising a reduced number of setæ (fixed with six or seven, movable with three setæ)	5.
2. Manducatory process of maxilla with but two apical setæ	3.
Manducatory process of maxilla with four or five apical setæ	4.
3. Seta IB opposite ESB and distad of EB; seta IST median, but between EST and ISB and as close to the latter as to IT; epistomal process present; with two small eyes; palpi slender, but normal (fig. 1 G); movable finger of chela with an accessory tooth-like sensorium near seta T (fig. 1 C).	*Pararoncus*, gen. nov.
Seta IB distinctly proximad of EB and situated on the distal part of the hand; seta IST only slightly proximad of EST and much closer to IT than to ISB; epistomal process absent; palpi excessively slender and elongate; movable finger of chela without such a sensorium.........	*Pseudoblothrus* Beier *.
4. With four eyes or eyeless, in the latter case the bulb of the tibia not sharply differentiated from the pedicel; IST grouped with ET, EST, and IT to form a distal group of four setæ widely separated from the similar but distinct basal group comprising ESB, EB, ISB, and IB	*Neobisium* Chamberlin
With two eyes or eyeless, in the latter case the bulb of the tibia sharply differentiated from its pedicel; IST and ISB more or less submedian, thus connecting the terminal and basal setal groups comprising ET, EST, IT, and ESB, EB, and IB, respectively..........................	*Roncus* L. Koch.
5. Fixed finger of chela with seven and movable finger with three tactile setæ (ISB and SB absent); manducatory process of maxilla with three apical setæ	*Microbisium* Chamberlin.
Fixed finger of chela with six, movable with three tactile setæ (IB, ISB, and SB absent)	*Afrobisium* Beier.

Pararoncus histrionicus, sp. n.
(Fig. 1.)

Holotype. Female (JC. 798.01001). From Japan. Taken at quarantine in Hawaii (lot 3985) and transmitted

* Data secured since the preparation of this paper indicates that *Pseudoblothrus* belongs to the family Syarinidæ rather than the Neobisiidæ.

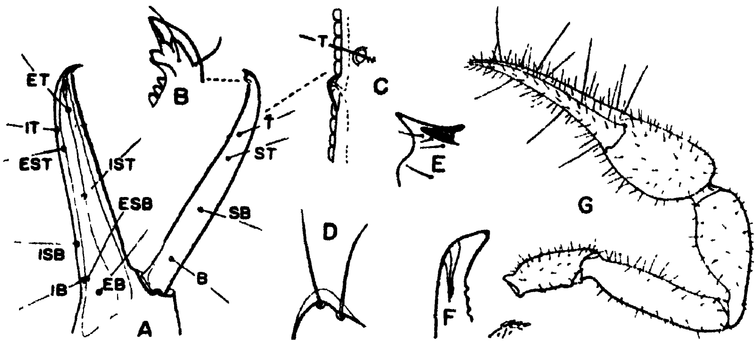
to me by R. V. Chamberlin in May, 1932. No additional material known. Author's collection.

Diagnosis.—Carapace longer than broad, with two very small eyes situated almost three ocular diameters from the anterior carapacal margin; epistomal process prominent. Carapacal chætotaxy: 4–8 (36±). Tergal chætotaxy (marginal series only):

12 : 15 : 14 : 14 : 15 : 16 : 16 : 18 : 14.

All tergites but the first with a pair of longitudinally opposite lateral discal setæ on each side of each tergite

Fig. 1.



Pararoncus histrionicus, gen. et sp. n. (female, holotype).

A. Extero-lateral aspect of right chela. B. Detail of movable finger of chela showing the venedens receptor. C. Accessory tooth or sensorium on movable finger of chela. D. Ventral aspect of tip of maxilla. E. Apical process of first coxa, ventral aspect. F. Tip of movable finger of chelicera, showing absence of spinneret and debouchment of the silk glands. G. Ventral aspect of left pedipalp

anterior to the marginal series. Manducatory process of maxilla rounded as usual in this subfamily, but provided with only two stout apical setæ instead of the usual four or five (fig. 1 D). Coxal area broadest across the maxillæ and first coxæ and extending posteriorly to point opposite the posterior margin of the second tergite. Palps (fig. 1 G) slender; all segments distinctly and evenly but not prominently granulate; inner face or femur, tibia, and hand more so than the rest; trochanter slender with straight nearly parallel sides, 2·5 times as long as broad; femur shorter than fingers, slightly but distinctly longer than tibia, and almost or quite as long as

carapace, 3·9–4·0 times as long as broad ; femur distinctly pedicellate, rounded exteriorly, convex interiorly near base and middle, then distally slightly concave ; tibia pedicellate and slenderly convex both interiorly and exteriorly, 2·7–2·8 times as long as broad ; chela slender, exteriorly hand and fingers forming a nearly straight contour from base to tip, hand smoothly convex interiorly ; chela 3·7–3·8 times as long as broad ; hand 1·4 times as long as broad and only very slightly deeper than broad ; marginal teeth of fixed finger numbering 63–64, all well developed and with rounded apices, scarcely less well developed posteriorly than anteriorly ; movable finger with 57 contiguous marginal teeth (exclusive of those forming the receptor venedens), which are only slightly less well developed than those of fixed finger (fig. 1 A). Receptor venedens comprising the first four marginal teeth, which have been raised on a crest and offset from the terminal tooth (fig. 1 B).

Measurements (mm.).—Female. Total length (KOH-cleared) 3·0. Carapace ·70 long; breadth (exact) indet. Palps : trochanter ·438 × ·175 ; femur 682 × ·172 ; tibia ·654 × ·236 ; chela 1·180 × ·318 broad and ·325 deep ; hand ·447 long ; fingers ·723 long. Leg i. : femur pars basalis ·375 × ·124 ; femur pars tibialis ·264 × ·118 ; tibia ·348 × ·084 ; metatarsus ·184 × ·068 ; tarsus ·285 × ·070. Leg iv. : femur (both segments as unit), dorsal length ·582, greatest length ·639, depth ·199 ; tibia ·595 × ·114 ; metatarsus ·236 × ·085 ; tarsus ·344 × ·082.

Remarks.—In addition to the foregoing characterization, the movable finger is exteriorly provided with a low, smooth crest or tooth-like outgrowth of probable sensory function which lies opposite, and almost contiguous to, the 21st and 22nd marginal teeth as already described under the generic heading (see also fig. 1 C). This structure, which is without known parallel in the suborder, is not conspicuous, scarcely exceeding the marginal teeth in height. It is noteworthy as occurring in the female (male as yet unknown). In some respects this species resembles *Roncus* (*Roncus*) *japonicus* (Ellingsen), but it differs in the size and proportions of the palpal segments. This difference may be due in part to differences in the methods of taking the measurements, and it is barely possible that re-study of Ellingsen's material may, indeed, show the two to be conspecific.

Suborder MONOSPHYRONIDA Chamberlin.

Superfamily **CHEIRIDIOIDEA** Chamberlin.

Family **Cheiridiidæ** Chamberlin.

1931. Cheiridiidæ Chamberlin, Stan. Univ. Pub. Univ. Ser. Biol. ser. 7 (1) p. 236.
1932. Cheiridiinæ Beier, 'Das Tierreich,' lviii. p. 6.

Remarks.—Chamberlin (1924), in his diagnosis of the subfamily Cheiridiinæ (= the present Cheiridiidæ), stated that the venom apparatus was lacking. In 1931 (Chamberlin, p. 132 and p. 236) this opinion was revised and the statement made that it occurred in the fixed finger only. This statement now requires a still further revision, since it has been definitely observed to occur in both fingers of at least one of the species here described, *Cheiridium minor*, sp. n., and is apparently, although not conclusively, also present in both fingers of *C. simulacrum*, sp. n. It seems to be truly lacking in the movable finger of species of *Apocheiridium*, although this requires verification. It would therefore not appear to be of higher than generic or perhaps subfamily value in this group. Its presence, however, is always exceedingly difficult to demonstrate completely in any species of the family I have yet observed, and, regardless of final conclusions, its systematic use will always be difficult. Further comparative studies are needed.

Beier (*l. c.*) has reduced the families Cheiridiidæ and Pseudocheiridiidæ as recognized by me to subfamily rank under the family Cheiridiidæ. This decision is one in which I cannot concur without more ample justification than is apparent from his publications. He makes the change without discussion or comment.

Cheiridium Menge. (Fig. 2.)

1855. *Cheiridium* Menge, N. Schr. Naturf. Gesell. Danzig, v. (2) p. 36.
1924. *Cheiridium* Chamberlin, Pan Pac. Ent. i. p. 37.
1931. *Cheiridium* Chamberlin, Stanford Univ. Pubs. Univ. Ser. Biol. Sci. vii. (1) p. 237.
1932. *Cheiridium* Beier, 'Das Tierreich,' lviii. p. 7.

Logotype. *Chelifer museorum* Leach.

Remarks.—Since its restricted definition by Chamberlin in 1924, this interesting genus has been considered monotypic, except for the fossil species *C. hartmanni* from the Baltic amber. Two additional well-marked species are here added, one from Hawaii and one presumably from

China. The latter represents a distinct subgenus, *Isocheiridium*, nov.

It is to be noted that the galea is sexually dimorphic in all species of this genus, comprising a simple unbranched stylet in the male and a slender, terminally trifid structure in the female (fig. 1 D). The serrula exterior has nine blades in each of the three known species. The two subgenera and three species here recognized may be separated by means of the following key. It should be noted that the proportions given are based upon palpal measurements which include the granulations; also that those for *C. museorum* are based upon male examples only, and those for *C. simulacrum* upon a single female specimen.

1. Vestitural setæ of palps strongly arcuate and exteriorly minutely multidenticulate (fig. 2 G); tergal setæ crenately lanceolate; setæ ISB and IB of chela distinctly distad of ESB and EB (about one areolar diameter); EST about opposite IST (fig. 2 A). .... *Isocheiridium minor*, [subgen. et sp. n.

   Vestitural setæ of palps arcuate but only monodenticulate (figs. 2 F & H); tergal setæ slender, strongly arcuate and acuminate (possibly minutely monodenticulate); setæ ISB and IB of chela scarcely or not at all distad of ESB and EB, nearly opposite; EST slightly but distinctly distad of IST (figs. 2 B & E) .... (*Cheiridium*, [subgen. typ.) 2.

2. Tibia 2·88 times as long as broad; palps relatively conspicuously granulate, height of the granulations proximally on inner femoral margin almost 1/5 as great as length of vestitural setæ of same part (fig. 2 F); fingers distinctly longer than hand without pedicel. fourth femur slightly narrower than breadth of palpal femur (including granulations) and 4·2 times as long as deep .... *museorum* (Leach)

   Tibia 2·54 times as long as broad; proximal granulations of inner femoral margin low, their height scarcely 1/10–1/15 length of individual vestitural setæ of same part (fig. 2 H); fingers and hand of nearly equal length; fourth femur slightly deeper than breadth of palpal femur (including granulations) and 3·4 times as long as deep .... *simulacrum*, sp. n.

CHEIRIDIUM, subgen. typ.

Logotype. *Chelifer museorum* Leach.

Diagnosis.—Vestitural setæ of palps each strongly arcuate and with a small single denticle on exterior part

of curve (figs. 2 F & H); vestitural setæ of tergites arcuate and acuminate (possibly minutely monodenticulate); seta ISB opposite EB and ESB; IB slightly distad of these three; seta EST slightly to distinctly distad of IST (figs. 2 B & E).

Cheiridium (Cheiridium) museorum (Leach).
(Figs. 2 E, F, & L.)

References.—See Beier, ' Das Tierreich,' lviii. p. 8, 1932, for literature citations concerning this species.

Remarks.—The principal appendicular proportions of this species, the reputedly nearly cosmopolitan book scorpion, are (length divided by breadth unless otherwise stated): Palps: trochanter 1·36; femur 4·58; tibia 2·88; chela 3·32 (3·93 times as long as deep), fingers 1·18 times as long as hand, depth of hand ·84 of breadth. Leg i. (length by depth): femur 3·35; tibia 3·36; tarsus 4·60; tibia and tarsus subequal in length. Leg iv. (length by depth); femur 4·25; tibia 4·70; tarsus 5·40; tibia 1·13 times as long as tarsus.

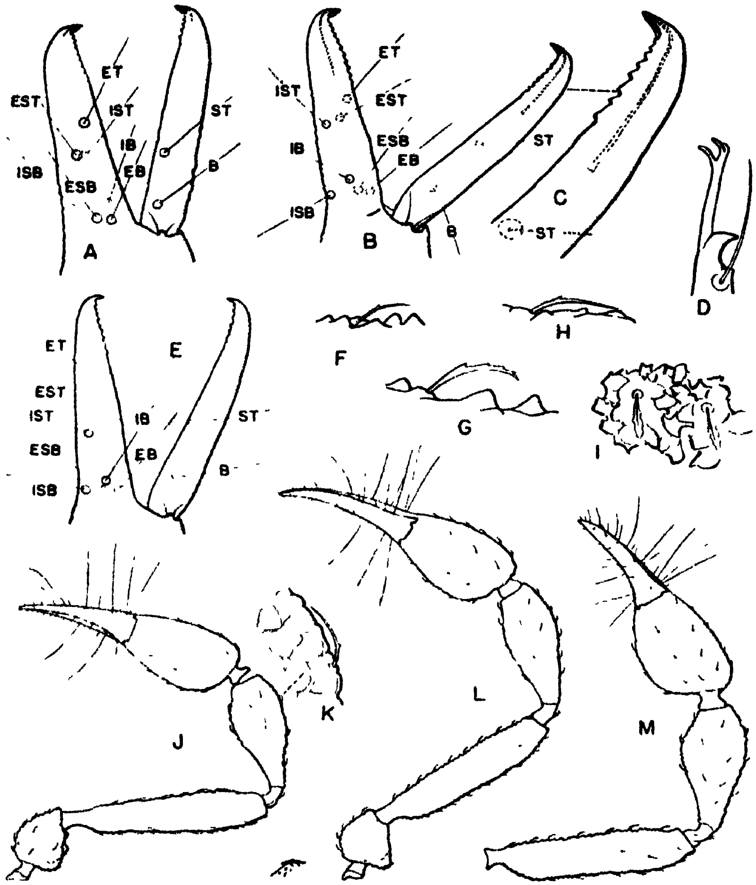
Measurements (mm.).—Total length 1·18. Abdominal breadth ·75. Carapace ·331 long by ·368 broad behind; cucullus ·074 long. Palps: trochanter ·158×·116; femur ·354×·075; tibia ·278×·094; chela ·438×·131 broad and ·111 deep; hand ·204 long; fingers ·242 long. Leg i. (male specimen 189·01002): femur, ·210×·070; tibia ·155×·046; tarsus ·153×·033. Leg iv.: femur ·298×·070; tibia ·223×·048; tarsus ·198×·037.

These measurements, unless otherwise noted, are from a KOH-cleared male specimen from France (JC. 189.01001).

They differ to some extent from those published by Beier (*l. c.*). Any significant discrepancy is in all probability due to difference in the method of taking the measurements. As Beier does not give his points of reference, verification is impossible. Moreover, the granulation, of the palpal segments especially, makes consistent results rather difficult.

The marginal teeth of the chela number about nine, and are best developed just proximad of the terminal tooth on each finger; the two basal teeth on the movable finger are nearly obsolete.

Fig. 2.



Cheiridium (*Cheiridium*) *museorum* (Leach) (male). E. Interior aspect of left chela (partially reconstructed). F. Vestitural setæ and granulations from outer base of palpal femur. L. Ventral aspect of left palp (JC. 189.01002).

Cheiridium (*Cheiridium*) *simulacrum*, sp. n. (female, holotype). B. Interior aspect of left chela. C. Tip of movable finger of chela showing venom apparatus. D. Tip of movable finger of chelicera showing the galea. H. Vestitural setæ and granulations from outer base of palpal femur. J. Ventral aspect of left palp. K. Vestitural seta and plaque-like granulations of palpal tibia.

Cheiridium (*Isocheiridium*) *minor*, sp. n. (female, allotype). A. Exterior aspect of right chela. G. Vestitural setæ and granulations from outer base of palpal femur. I. Typical tergal setæ. M. Ventral aspect of left palp. Trochanter omitted.

For purposes of comparison with the new species herein described, the palps (fig. 2 L), the chela (fig. 2 E), and a femoral seta (fig. 2 F) are illustrated herein.

Cheiridium (Cheiridium) simulacrum, sp. n.
(Figs. 2, B, C, D, H, J, & K.)

Holotype. Female (JC. 791.01001) collected October 1, 1931, in house at Wahiawa, Oahu, Hawaii, by H. Hagan. No additional material available. Author's collection.

Diagnosis.—General facies that of *Cheiridium museorum*, to which without doubt it is closely related. Carapace 1·3 times as broad behind as long and 5·1 times as long as cucullus; cucullus about 2·4 times as long as ocular diameter; emarginate median depression of posterior disc of carapace pronounced, longer than broad and ovate in outline. Tergites bordered by 18–20 marginal setæ. Sub-basal seta of chelicera subapically dentate as in *C. museorum*; serrula exterior with nine ligulate teeth, of which the basal is very much broader and somewhat longer than the rest (as in *C. museorum*); fixed finger of chelicera with three large and two small marginal teeth; galea long and slender and extending beyond tip of galeal seta, apically with three short, scarcely recurved branches; flagellum as in *C. ferumoides*. Palps less granular than in *C. museorum*, the individual granules more or less squamose (fig. 2 K) and both absolutely, as well as relative to the setæ, of lower relief than in *C. museorum* (fig. 2, compare H and F); vestitural setæ of palps similar to those of *C. museorum*, but much more closely appressed to the segment (fig. 2 J); tibia markedly shortened owing to pronounced initial bend in tibial pedicel and fingers subequal to hand in length; palpal appearance otherwise same as that of *C. museorum* (fig. 2, compare J and L). Palpal proportions: trochanter 1·52 times as long as broad, longer than tarsus of leg i. but shorter than that of leg iv.; femur gently expanded from base for three-fourths its length, thereafter suddenly narrowed, 4·6 times as long as broad; tibia conspicuously pedicellate, the expansion of the pedicel into the bulb occurring about one-third the length of the segment from its base, 2·54 times as long as broad, pedicel more acutely angled than in *C. museorum* (figs. 2 J & L);

chela (without pedicel) 3·40 times as long as broad and 4·18 times as long as deep ; hand (without pedicel) subequal in length to fingers and 1·71 times as long as broad. Chætotaxy and venom apparatus of chela as illustrated (fig. 2 B) ; marginal teeth of chela inconspicuous and occurring on apical third of fingers, 10 on fixed and 8 on movable fingers (figs. 2 B & C).

Femur of leg i. about as long as tibia of fourth leg and 3·1 times as long as deep ; tibia and tarsus of fore legs of about the same length ; tibia 3·6 times as long as deep ; tarsus 4·9 times as long as deep. Leg iv. : femur slightly deeper than greatest breadth of palpal femur and 3·4 times as long as deep ; tibia but little longer than tarsus (1·04 times), shorter than length of palpal fingers, and 4·4 times as long as deep ; tarsus 6·0 times as long as deep.

Measurements (mm.).—Female holotype. Total length, 1·12. Abdominal breadth ·76. Carapace ·320 long by ·420 broad behind ; cucullus ·063 long ; ocular diameter ·026. Palps : trochanter ·162 × ·103 ; femur ·355 × ·077 ; tibia ·260 × ·102 ; chela ·430 × ·127 broad and ·103 deep ; fingers ·221 long ; hand (without pedicel) ·208 long. Leg i. : femur ·195 × ·062 ; tibia ·146 × ·040 ; tarsus ·144 × ·029. Leg iv. : femur ·272 × ·079 ; tibia ·195 × ·044 ; tarsus ·188 × ·031.

Remarks.—The most important points of difference between this species and *museorum* are given in full in the preceding key. It is important to note that the proportions given for *C. museorum* are based upon males, whereas the present species is known only from the female. With both sexes available differences might be either more or less distinct.

ISOCHEIRIDIUM, subgen. nov.

Orthotype. *Cheiridium (Isocheiridium) minor*, sp. n.

Diagnosis.—Vestitural setæ of palps arcuate and minutely multidenticulate along outer curve (fig. 2 G) ; vestitural setæ of carapace and tergites apparently not markedly arcuate and distinctly oblanceolate or spatulate with crenate edges (fig. 2 I) ; setæ IB and ISB almost opposite and both distinctly anterior to EB and ESB ; EST opposite IST (fig. 2 A).

Cheiridium (Isocheiridium) minor, sp. n.
(Figs. 2 A, G, I, & M.)

Type-material.—Holotype, male (JC. 856.01001); allotype, female (JC. 856.01002). Found on leaves of *Lophærum gracile* from China. Taken alive May 27, 1936, at quarantine in New York City, cargo of SS. 'President Lincoln,' by Inspector Sartor. (N.Y. Entry No. 842142–3. Bureau of Entomology and Plant Quarantine No. 36–16756.) No other material known. Author's collection.

Diagnosis (both male and female unless otherwise noted).—Facies typical; very similar in general appearance to, but smaller than, *Cheiridium museorum*. Carapace typical; median depression of posterior disc pronounced and extending to and involving the first tergite; appearance in most respects as in the genotype. Vestitural setæ of palps arcuate and with 3–5 denticles along outer curve (fig. 2 G). Median tergites with 18–20 marginal setæ in female and 14–16 in male. Tergal setæ crenately margined and oblanceolate in form (fig. 2 I). Cheliceræ typical of genus; galea slender, a simple acuminate shaft in male, but with at least two, and more probably three, short, recurved, terminal branches in female; serrula exterior with nine blades, of which the basal one is widened and spatulate; flagellum as in *C. museorum*. Cheliceral chætotaxy: *ls* absent, *b* apparently non-denticulate. Palps typical; granulation pronounced, much as in *C. museorum*; trochanter 1·3–1·4 times as long as broad; femur distinctly broadest distally, 4·0 (in male) and 4·5–4·6 (in female) times as long as broad; tibia rather robust, 2·4–2·5 times as long as broad; chela, without pedicel, 2·9–3·0 times as long as broad, and 3·3 times as long as deep; hand, with pedicel, 1·65–1·69 times as long as broad; hand, with pedicel, distinctly longer than fingers, without pedicel slightly longer than fingers, but practically subequal thereto. Chætotaxy of chela as figured (fig. 2 A). Marginal teeth of chela almost vestigial on movable finger, but apical tooth well developed and acute and with about four nearly terminal marginal teeth; seven or eight weakly developed teeth occurring distally on fixed finger (fig. 2 A). Leg i.: femur subequal to fourth tibia, 3·1–3·2 times as long as deep; tibia slightly longer than

tarsus and 3·4 times as long as deep ; tarsus 4·6–4·8 times as long as deep. Leg iv. : femur longer than palpal tibia, 3·5 (male)–3·7 (female) times as long as deep ; tibia but little longer than tarsus (1·05–1·09 times) and 4·3–4·4 times as long as deep ; tarsus 5·8–6·0 times as long as deep.

Measurements (mm.).—Male. Total length, ·93. Abdominal breadth ·65. Carapace ·29 long, breadth indet. ; cucullus ·052 long ; ocular diameter ·022. Palps : trochanter ·104–·114 × ·081–·083 ; femur ·265–·267 × ·063–066 ; tibia ·212–·214 × ·085 ; chela ·316 × ·107 broad and ·096 deep ; hand ·158 long (with pedicel ·177) ; fingers ·166 long. Leg i : femur ·147 × ·048 ; tibia ·112 × ·033 ; tarsus ·110 × ·023. Leg iv. : femur ·219 × ·062 ; tibia ·162 × ·037 ; tarsus ·155 × ·0266.

Female. Total length about 1·0. Abdominal breadth ·77. Carapace indet. Palps : trochanter ·114–·120 × ·085 ; femur ·291 × ·063–·064 ; tibia ·217–·219 × ·091 ; chela ·328–·330 × ·112–·113 broad and ·099 deep; hand ·169 long (with pedicel ·190) ; fingers ·162 long. Leg i. : femur ·165 × ·051 ; tibia ·121 × ·036 ; tarsus ·118 × ·026. Leg. iv. : femur ·232 × ·062 ; tibia ·177 × ·040 ; tarsus ·162 × ·027.

Remarks.—In addition to many good morphological characters, the small size of this species renders it distinctive (femoral length ·26–·29 mm. as compared with ·35–·36 mm. in *C. simulacrum* and *C. museorum*). It may be noted that the essential pattern of the male genitalia is the same as in *C. museorum*.

Superfamily **CHELIFEROIDEA** Chamberlin.

Family **Chernetidæ** Chamberlin.

Subfamily *Chernetinæ* Beier.

Rhopalochernes navigator, sp. n.

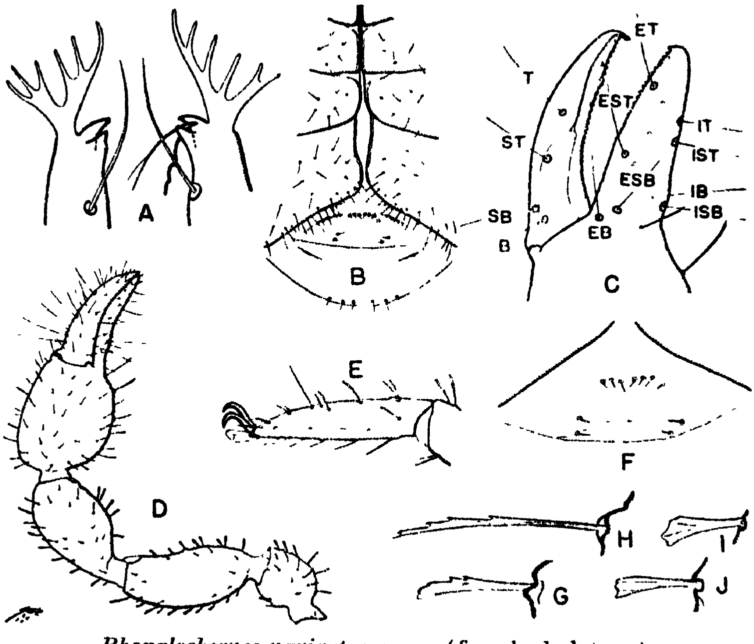
(Fig. 3.)

Holotype. Female (JC. 812.01001), Tutuila, Samoa. Taken at quarantine inspection in Hawaii (lot 4827), Aug. 4, 1932. Deposited in Bishop Museum.

Diagnosis.—Carapace and tergites evenly granulate; carapace shorter than posterior breadth ; eyeless (eyespots apparently also absent). Carapacal furrows weakly

impressed, anterior furrow submedian and gently procurved; posterior furrow typical; tergites divided with exception of first and eleventh; scuta "deliquescently" merging into the interscleritic membranes; vestitural setæ of carapace and tergites strongly clavate (fig. 3 I); tergites 1–3 uniseriate, the rest uniseriate except for the customary lateral discal seta on each scutum; with about ten marginal setæ each (five per scutum); sternites

Fig. 3.



Rhopalochernes navigator, sp. n. (female, holotype).
A. Subventral aspect of left and right galeæ. B. Pseudosternum and female genital area. C. Externo-lateral aspect of left chela. D. Ventral aspect of right palp. E. Lateral aspect of fourth tarsus. F. Genital area of female. G and J. Vestitural setæ from femur of palps. H. Semitactile vestitural seta from inner face of chela at base of fixed finger. I. Tergal seta.

(Figs. G, H, I, and J drawn to same scale.)

4–11 divided by an obscure stripe; sternites smooth and with about 20 acuminate border setæ per sternite (ten per scutum), lateral discal setæ of sternites 8, 9, and 10 moderately elongate and denticulo-clavate (most other sternal setæ acuminate); sternite 11 with a short lateral

and submedian pair of acuminate pseudotactile setæ; tergites 10 and 11 with lateral discal setæ elongated but still strongly denticulo-clavate; tergite 11 with a submedian pair of similarly elongated clavate setæ and possibly with a similar (or acuminate ?) lateral pair as well (broken from only available specimen). Pleural and intersclerotic membranes markedly wrinkled and hispid. Anus wholly ventral. Maxillary disc smooth. Coxal area broadest across posterior border of second coxæ; intercoxal space between posterior portion of coxæ 3 and anterior portion of coxæ 4 about four or five times as broad as space between posterior portion of fourth coxæ or between the other pedal coxæ, thus delimiting a small and elongate, but definite pseudosternum (fig. 3 B). Setæ *sb* and *b* of chelicera terminally denticulate; seta *es* acuminate; flagellum 3-bladed, the anterior blade slender, but still nearly as broad as the combined width of the other two, anteriorly serrate; serrula exterior with 16 blades; galea antler-like with six branches, which may differ bilaterally on the same specimen but still retain the characteristic facies (fig. 3 A). Palps (fig. 3 D) relatively robust, evenly but rather coarsely granulate, and vestitured by moderately robust semiclavate setæ (figs. 3 G, H, & J); trochanter 1·64 times as long as broad; femur scarcely longer than tibia, 1·53 times as long as trochanter and 2·30 times as long as broad; tibia about as long as hand with pedicel and 2·10 times as long as broad; chela robust, longer than breadth of carapace, 1·63 times as long as tibia and 2·50 times as long as broad; fingers very slightly shorter than hand (exclusive of pedicel); chela with tactile setæ as shown in fig. 3 C; nodus ramosus of venom apparatus slightly proximad of seta T; movable finger with 31, fixed finger with 27 or 28, marginal teeth; movable finger with four evenly spaced accessory teeth anterior to nodus ramosus and closely parallel to marginal series; fixed finger with three similar accessory teeth, the basal one of which is slightly proximad of seta ET; sense-spots inconspicuous; a series of three occurring exteriorly on fixed finger between setæ ET and EST; a single small sense-spot exteriorly on movable finger between setæ ST and SB; interiorly with two or three sense-spots on base of movable finger. Leg i.: femur (dorsal length of both

subsegments) a little longer than breadth of chela an 2·56 times as long as deep; tibia ·9 as long as tars us about as long as breadth of palpal tibia, and 2·8 times as long as deep; tarsus slightly longer than tibia and 4·3 times as long as deep. Leg iv.: femur (greatest length of combined subsegments) 1·35 times as long as tibia and 3·36 times as long as deep; tibia 1·12 times as long as tarsus and 3·9 times as long as deep, tarsus 4·4–4·5 times as long as deep. Tactile seta of tarsus iv. about two-thirds (·64) of tarsal length removed from the base of segment (fig. 3 E). Genital area of female characterized by a great reduction in the number of opercular setæ; pattern as shown in figs. 3 B & F.

Measurements (mm.).—Female. Total length 1·49. Abdominal breadth ·75. Carapace ·528 long and ·570 broad (posteriorly). Palps: trochanter ·256 × ·156; femur ·392 × ·170; tibia ·385 × ·182; chela ·626 × ·248; hand without pedicel ·333 long; with pedicel ·389 long; fingers ·320 long. Leg i.: femur (dorsal length of combined subsegments) 2·61 × ·102; tibia ·181 × ·065; tarsus ·202 × ·047; leg iv.: femur (greatest length of combined subsegments) ·363 × ·108; tibia ·270 × ·069; tarsus ·240 × ·054.

Remarks.—*Rhopalochernes* has heretofore been known only from the neotropical region. In Beier's key ('Das Tierreich,' lviii. p. 140 (1932) this species runs to *R. antillarum* (With). The following couplet will serve to separate these two rather closely similar forms:—

Carapace longer than broad; hand (without pedicel) distinctly longer than fingers (1·3 times); antero-distal margin of tibia distinctly concave; fore tibia slightly longer than tarsus .... *antillarum* (With).
Carapace slightly broader than long; hand only very slightly longer than fingers (1·04 times); antero-distal margin of tibia nearly straight, slightly convex; fore tibia slightly but distinctly shorter than tarsus .... *navigator*, sp. n.

Subfamily *Lamprochernetinæ* Beier.

Haplochernes Beier.

1932. *Haplochernes* Beier, 'Das Tierreich,' lviii. p. 108.
1933. *Haplochernes* Beier, Zool. Jahrb., Abt. System. Okol. u. Geogr. Tiere, lxiv. p. 513.

Remarks.—Although the pleural membrane of the abdomen of representatives of this genus is smoothly

reticulate rather than truly striate and the pseudo-tactile setæ of the fourth tibia are only very weakly differentiated (fig. 4 J), I have no hesitancy in transferring this genus from the Chernetinæ, where it was originally placed by Beier, to the subfamily Lamprochernetinæ, to which it clearly shows its affinities in the pattern of the male and female genitalia. The following key will serve to separate those representatives of the genus so far known from the area here considered. Other representatives of the genus occur in the oriental and Australian regions as well as in Madagascar and Japan :—

1. Galea with 10 branches; large species; femur about ·87 mm. long; fingers of chela with about 12 paradental accessory teeth; palps granular .... [Samoa. *atrimanus* (Kästner).
   Galea with five or six branches; smaller species; femur ·50–·75 mm. long; with 6–8 or fewer paradental accessory teeth; palps weakly granular or almost smooth (at most the anterior face of femur and tibia weakly granular) .... 2.
2. Hand 1·5–1·6 times as long as fingers; setæ ISB and IST farther apart than ST and SB .... [Samoa. *buxtoni* (Kastner).
   Hand 1·04–1·2 times as long as fingers; setæ ISB and IST about as far apart as ST and SB .... 3.
3. Both fixed and movable fingers with 5–7 paradental accessory teeth on distal half of fingers; venom duct not medianly swollen; setæ B and SB about 1 areolar diameter apart; larger species, chela of female 1·15–1·34 mm. long; with 60–70 marginal teeth on fingers of chela ...... *funafutensis* (With).
   Mobile finger of chela with accessory teeth completely lacking; fixed finger with two distal and one subdistal accessory teeth exteriorly; venom duct with a conspicuous median swelling (fig. 2 B); setæ B and SB separated by two areolar diameters; smaller species, female chela 1·06 mm. long; with 51–53 marginal teeth on fingers of chela .... *ellenæ*, sp. n.

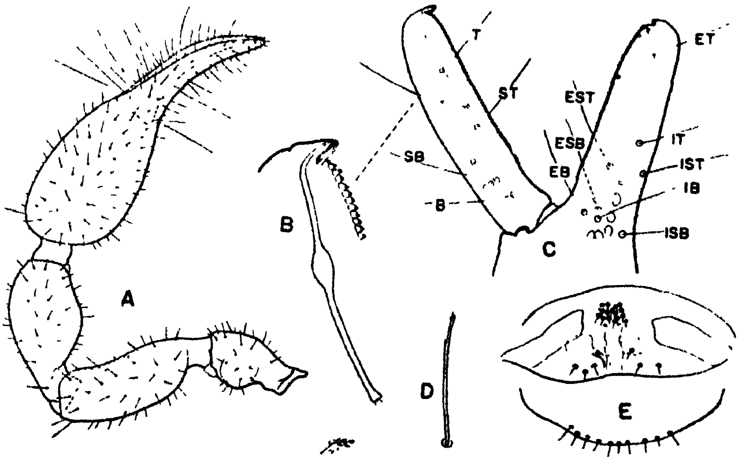
Haplochernes ellenæ, sp. n.
(Fig. 4.)

Holotype. Female (JC.235.01001). Viti Levu, Colo-i-Suva, Fiji. Collected by E. H. Bryan, June 21, 1924. Author's collection.

Diagnosis (based on female only).—Facies extremely similar to that of *H. funafutensis* (With). Carapace, tergites, and palps smooth and polished except for inner

face of femur, which is distinctly but weakly granulate. Vestitural setæ superficially long and pointed, actually minutely denticulate (fig. 4 D). Eye-spots distinct. Carapace distinctly longer than broad (1·24 times); both furrows distinct, anterior furrow distad of median, posterior furrow nearer posterior carapacal margin than anterior furrow; carapace 2·2 times as long as distance from anterior carapacal margin to anterior furrow. Tergites 1–3 narrowed and entire, 4–10 obscurely divided by a linear stripe or impression; scuta weakly sclerotic, but not merging into intersclerotic and pleural membranes;

Fig. 4.



Haplochernes ellenæ, sp. n. (female, holotype).

A. Dorsal aspect of left palp. B. Tip of movable finger of chela showing inflated venom duct. C. Interior aspect of right chela. D. Vestitural seta from inner face of palpal tibia. E. Genital area of female.

tergites 1–3 uniseriate, bordered by ten setæ; tergites 4–10 biseriate, with four discal and 10–15 marginal setæ. Pleural membrane smoothly rēticuloplicate; sternites similar to tergites, biseriate and with four discal and 15–18 marginal setæ. Segment 10 with three pairs of dorsal and two pairs of ventral, discal, semitactile setæ; segment 11 with two pairs of pseudotactile setæ dorsally and ventrally. Galea of same general appearance as in *H. funafutensis* (With), but with only five branches (in the holotype and only known specimen); serrula exterior

with 19 ligulate teeth ; lamina interior with three dentate subapical lobes ; setæ *sb* and *b* of chelicera terminally denticulate (character of *es* indeterminable). Palps (fig. 4 A) very similar to those of *H. funafutensis* (With) ; trochanter with a distinct dorsal protuberance and about 1·8 times as long as broad ; femur 1·53 times as long as trochanter, ·95 as long as tibia, and 2·57 times as long as broad ; tibia 2·3 times as long as broad ; chela 3·19 times as long as broad ; hand slightly but distinctly broader than deep (1·04 times), and slightly but distinctly longer than fingers (1·07 times). Chætotaxy and dentition of chela as shown in fig. 4 C ; movable finger with 51–53, fixed finger with 53 marginal teeth ; accessory teeth reduced in number, movable finger with none ; fixed finger interiorly with one apical tooth, exteriorly with two distal teeth and one submedian accessory tooth (fig. 4 C) ; nodus ramosus about three areolar diameters distad of seta ST ; duct of venom apparatus with a distinct ovate swelling or enlargement distad of seta T (figs. 4 B & C) ; setæ B and SB separated at least two areolar diameters ; setæ IST and EST distinctly nearer to seta IT than to ESB ; with a pseudotactile seta on movable finger between T and ST and scarcely distad of nodus ramosus ; no terminal or subterminal pseudotactile seta noted (may be broken and lost from only available specimen). Sense-spots on both fingers, two or three interiorly near base of movable finger, about 6 interiorly and basally to subbasally on fixed finger and at least one basally to subbasally on fixed finger (fig. 4 C). Sense-spots in only available specimen not uniform in size. Leg i. : femur (dorsal length of both subsegments) 1·36 times as long as tibia and 2·9 times as long as deep ; tibia with a subterminal sense dome, 1·04 times as long as tarsus and 3·09 times as long as deep ; tarsus 4·0 times as long as deep. Leg iv. : femur (greatest length of both subsegments) 1·44 times as long as tibia and 3·0 times as long as deep ; tibia with a short, submedian, denticulate pseudotactile seta, 1·26 times as long as tarsus and 3·35 times as long as deep ; tarsus 1·2 times as long as fore tarsus and 4·0 times as long as deep. Fourth tarsus with a subbasal sense dome and a slender and completely acuminate pseudotactile seta which is placed ·32 of tarsal length from its base. Female genital area

of typical lamprochernetine type, nearly or quite the same as in *H. funafutensis* (With) (fig. 4 E).

Measurements (mm.).—Female, holotype. Total length 2·80; abdominal breadth 1·21. Carapace ·76 long and about ·61 broad posteriorly. Palps: trochanter ·359 × ·195; femur ·548 × ·213; tibia ·576 × ·248; chela 1·061 × ·333 broad and ·320 deep; hand ·574 long; fingers ·538 long. Leg i.: femur (dorsal length of combined subsegments) ·378 × ·129; tibia ·278 × ·090; tarsus ·266 × ·066. Leg iv.: femur (greatest length of combined subsegments) ·589 × ·195; tibia ·408 × ·122; tarsus ·324 × ·081.

Remarks.—This species is apparently rather close to *H. funafutensis* (With), but differs distinctly in certain important respects. See the generic discussion for an itemization of the more important points of difference.

The holotype carried a flat circular disc of eight developing embryos. The entire disc measured ·39–·42 mm. in diameter.

Lamprochernes Töm.

References.—For literature citations concerning this genus see Beier, 'Das Tierreich,' lviii. p. 82 (1932).

Remarks.—The occurrence of at least two species of this otherwise holarctic genus in the islands of the South Pacific is of more than ordinary interest although not unique, being paralleled, for example, by the distribution of the genera *Solinus* and *Sternophorus*, both of which have North American and Australian representatives. It is possible, of course, that later study may reveal characteristics sufficiently distinct to permit the segregation of these two species from Lamprochernes, but such is impossible at this time.

The two species here described may be separated by means of the following key:—

1. Large species, male, 3·7 mm. long (femur, ·867 mm. long); fingers much shorter than hand, which is as long as tibia; fingers scarcely longer than breadth of hand; fixed finger with 37, movable finger with 48 marginal teeth; seta EST and IST nearly opposite; fourth pedal femur 2·3–2·5 times as long as deep; with 10–14 evenly spaced accessory teeth exteriorly on each finger .... *samoanus*, sp. n

4

Reprinted from the Journal of the British Association, Blackpool, September 9–16, 1936, page 38.

Prof. G. D. HALE CARPENTER, M.B.E.—*Entomology and Natural Selection* (11.25).

The following are difficult to explain without Natural Selection :

(1) Mimicry in Uganda of species of the Acraeine genus of butterflies *Bematistes* (= *Planema*) by forms of one species of Nymphaline *Pseudacraea eurytus*. Not only are local species of *Bematistes* mimicked by forms of *eurytus* numerically proportional to their models, but if the protective influence of *Bematistes* is diminished by their scarcity the forms of *eurytus* depart from strict resemblance and intermediates abound. (2) Experiments with a monkey under natural conditions showed that out of 143 species of insects with conspicuous (aposematic) coloration 120 were distasteful, and out of 101 with concealing (procryptic) coloration 83 were edible. Lycid beetles, much mimicked in all tropics, were not eaten even under conditions of considerable hunger : they are typically aposematic. Procryptic weevils and Mantidae were greedily eaten. (3) Adaptations of flowers and insects for mutual benefit. A very peculiar relationship exists between an Australian orchid and an Ichneumon, the male of which, deceived by odour like that of its female, enters a flower backwards and while depositing its spermatozoa on the stigma causes the pollinia to adhere to its abdomen and thus withdraws them.

Small species, male, 1·68 mm. long (femur, ·42—·44 mm. long); fingers and hand subequal in length; fingers much longer than breadth of hand; tibia much longer than hand; fixed and movable fingers with 26–27 marginal teeth; seta EST distinctly anterior to IST; fourth pedal femur 3·06 times as long as deep; exteriorly with only two or three accessory teeth on each finger .... *kanaka* Chamberlin.

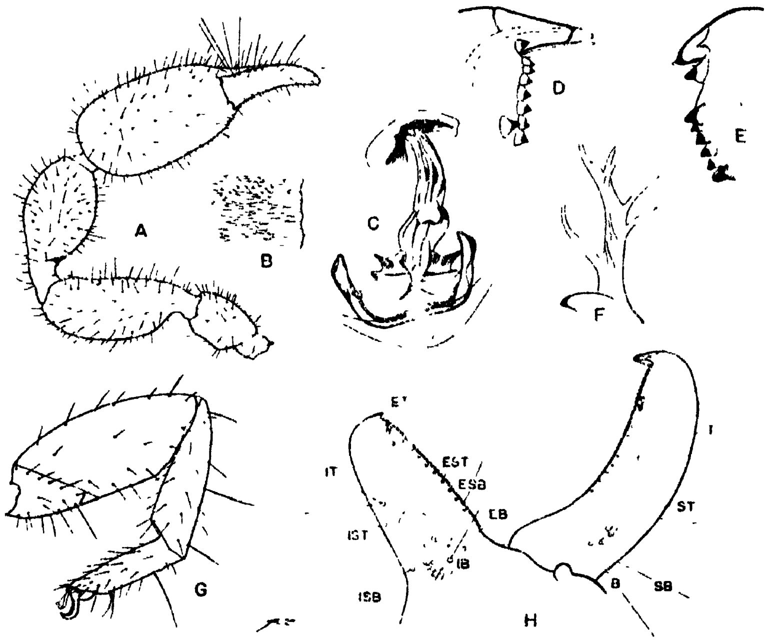
Lamprochernes samoanus, sp. n.
(Fig. 5.)

Holotype. Female (JC. 233.01001), Salailua, Savaii, Samoa. Collected by E. H. Bryan, May 22, 1924. Author's collection.

Diagnosis.—Carapace distinctly broader than long (1·2 times); anterior groove prominent and nearly median; posterior groove obscure and nearly median between anterior groove and posterior margin of carapace. Eyes absent; eye-spots obscure or absent. Carapace, tergites, and palps smooth and glossy except for a few inconspicuous and rounded granules on inner profile of palpal femur and distinct granulations interiorly at base of fingers. All tergites and sternites except 1, 2, and 11 divided more or less clearly by a nearly linear suture (very obscure on anterior tergites); tergites 2 and 3 markedly narrowed; tergal chætotaxy of an imperfect biseriate type medianly with about four discal and ten marginal setæ, posteriorly with four to six discal and twelve to fourteen marginal setæ. Sternal chætotaxy similar but with four discal and sixteen to eighteen marginal setæ. Tergites with prominent lateral maculæ or spots occupying nearly the full outer half of each scuta; similar but less prominent spots on sternites. Scuta sharply rectangular, medianly only about 1·4 broader than long. Pseudotactile setæ developed on tenth and eleventh abdominal segments. Pleural membrane reticulostriate (fig. 5 B). Vestitural setæ long and slender and only very minutely denticulate. Setæ *esb*, *eb*, and *es* of chelicera denticulate; lamina interior with three dentate subapical lobes; serrula exterior with nineteen ligulate teeth; galea prominent (fig. 5 F) with nine simple, slightly curved branches, the interior basal branch simple, but nearly twice as long as the others. Palps

robust (fig. 5 A); trochanter with a prominent and rather slender cone-like protuberance, 1·8–1·9 times as long as broad and about 1·5 times as long as deep; femur robust, gently concave anteriorly and strongly convex posteriorly; slightly shorter than tibia, 1·6 times as long as trochanter and 2·2–2·3 times as long as broad; tibia slightly but distinctly shorter than carapace, 2·2 times as long as broad; chela very robust, fingers only slightly longer

Fig. 5.



Lamprochernes samoanus, sp. n. (male, holotype).

A. Ventral aspect of right palp. B. Reticulo-striate pleural membrane of abdomen. C. Sketch of male genitalia (cleared). D. Tip of movable finger of chela showing venedens and lamina defensor. E. Tip of fixed finger of chela showing receptor venedens and lamina defensor of functionless venedens. F. Galea. G. Lateral aspect of leg iv. H. Intero-lateral aspect of left chela.

than breadth and shorter than depth of hand; chela 2·6 times as long as broad and 1·6 times as long as tibia; fingers much shorter than hand, which is subequal to the tibia in length; fixed finger with about 37, movable finger with about 47 marginal teeth, the basal ones mostly

obsolete; movable finger interiorly with a contiguous pair of accessory teeth opposite the tenth to twelfth marginal teeth, and a series of fourteen evenly spaced accessory teeth exteriorly which extend nearly the full length of the dental margin (figs. 5 D & H); fixed finger with a similar series of eleven or twelve accessory teeth exteriorly and three subapical accessory teeth interiorly (figs. 5 E & H); chætotaxy of chela as illustrated (fig. 5 H); setæ SB and B nearly contiguous, scarcely an areolar diameter apart; seta ST nearer SB and B than T; nodus ramosus opposite twenty-second marginal tooth and caudad of T; seta ET nearly terminal, opposite sixth and seventh marginal teeth; IT distad of median and much distad of EST; EST and IST about opposite each other; ISB, IB, ESB, and EB proximad of basal marginal teeth; a submedian pseudotactile seta occurring on each finger (no distal one was noted on the movable finger, but it may have been broken off). Dense cluster of about sixteen sense-spots interiorly between ISB and IB together with a cluster of about four spots slightly proximad of IST and EST, about five sense-spots interiorly on movable finger opposite and distad of SB and B; fixed finger with two or three subbasal sense-spots exteriorly. Leg i.: femur (both segments) slightly longer than breadth of chela, 1·37–1·38 times as long as tibia, and 2·5–2·7 times as long as deep; tibia 1·16–1·18 times as long as tarsus and 3·0 times as long as deep; tarsus 3·7–3·8 times as long as deep; leg iv. (fig. 4 G); femur (greatest length of both subsegments) 1·32–1·36 times as long as tibia and 2·3–2·5 times as long as deep; tibia as long as depth of chela, 1·42–1·43 times as long as tarsus, and 3·3–3·7 times as long as deep; tarsus 3·7–3·8 times as long as deep. Male genitalia of characteristic lamprochernetine type, about as shown in accompanying sketch (fig. 5 C).

Measurements (mm.).—Holotype. Total length 3·7. Abdominal breadth, 1·1. Carapace ·94 × ·79. Palps: trochanter ·545 × ·294; femur ·867 × ·381; tibia ·900 × ·410; chela 1·461 × ·560 broad and ·645 deep; hand ·915 long; fingers ·587 long. Leg. i: femur (dorsal length of both subsegments) ·588 × ·221–·232; tibia ·430–·426 × ·144–·143; tarsus ·372–·361 × ·099. Leg iv.: femur (greatest length of both subsegments) ·885–·869 ×

·356–·377 ; tibia ·652–·656 × ·174–·202 ; tarsus ·459 × ·459 × ·120–·125.

In the foregoing pedal measurements both legs were measured ; where these differ, the measurement for the left leg is given first and separated from the homologous measurement of the right leg by a dash.

Remarks.—This species is quite different from *L. kanaka* Chamberlin, as has already been pointed out, although in palpal proportions the two species are nearly identical.

Family **Cheliferidæ** Hagen.

Subfamily *Cheliferinæ* Simon.

Tribe Lophochernetini Chamberlin.

Lophochernes bifissus (Simon).
(Fig. 6.)

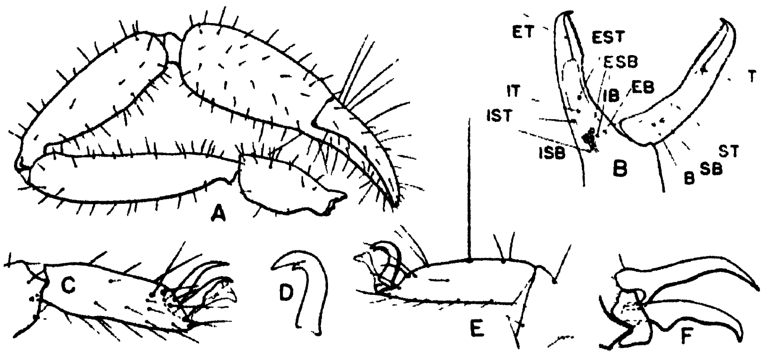
1899. *Chelifer bifissus* Simon, Ann. Soc. Ent. Belg. xliii. p. 121.
1931. *Chelifer bifissus* Simon, Chamberlin, Stanford Univ. Pub. Univ. Ser. Biol. Sci. vii. figs. 10, I ; 42, S ; and 46, M.
1932. *Lophochernes bifissus* (Simon), Beier, 'Das Tierreich' lviii. p. 246.

Material examined.—Male (JC. 220.01001), labelled "*Chelifer bifissus* Simon. Sumatra." Exchange through L. Fage of the Paris Museum. Probably part of Simon's original material.

Diagnosis.—(Addenda. All the following observations are from the above specimen.) Contrary to Beier's statement, the tergites are all undivided, although, instead of the usual divisional suture, the sclerotization and pigmentation are lighter than usual, giving the impression of a line of division. Carapace tessellate but smooth—(not at all granulate). Tergites 1–6 with tergal crests. Sternites 4–10 showing obscure partial to nearly complete division. Setæ *sb*, *b*, and *es* of chelicera at least minutely denticulate ; serrula exterior with sixteen teeth. Anterior blade of flagellum almost simple (a single small lateral denticle occurs). Fore claws asymmetrical, but untoothed (figs. 6 C & F) (see also Chamberlin, *l. c.* fig. 42, S). Coxal sacs with only six or seven internal "setæ," which are separated into a lateral and a distal group of three or four each (Chamberlin, *l. c.* fig. 46, M). Pseudotactile setæ of tarsus iv. superficially median, actually ·41 of tarsal length from its base (fig. 6 E). Palps (fig. 6 A) smooth and polished. Trochanter 2·21

times as long as broad; femur slightly longer than carapace and 3·98 times as long as broad; tibia slightly shorter than femur and 3·32 times as long as broad; chela 3·42 times as long as broad; hand broader than deep (1·2 times) and longer than fingers (1·18 times); chela (fig. 6 B) distinctly gaping; marginal teeth of fixed finger numbering 21 or 22, of movable finger 25 or 26; on both fingers the basal four or five teeth that lie within the concavity producing the gape being reduced and more or less separated; all tactile setæ of the interior series of the fixed finger lying proximad of EST, which, in turn,

Fig. 6.



Lophochernes bifissus (Simon) (male, JC. 220.01001).

A. Ventral aspect of right palp. B. Intero-lateral aspect of left chela. C. Tarsus i. showing secondary sexual modifications. D. Tarsal claw from leg iv. E. Lateral aspect of tarsus iv. F. Sexually modified tarsal claws of leg i.

is distinctly proximad of median; IST laterad of, and about one areolar diameter proximad of, IT, which is opposite and about 1–½ areolar diameters proximad of EST; SB and B an areolar diameter apart; T anterad of median; ST closer to B–SB than to T; sense-spots occurring interiorly on fixed finger and exteriorly on both fingers; a cluster of 10–12 occurring between ISB and IB; two distad of ESB and two or three between B, SB, and ST. Leg i.: femur (dorsal length of both subsegments) 1·5 times as long as tibia and 3·06 times as long as deep; tibia subequal in length to breadth of chela and 2·54 times as long as deep; tarsus as long as depth of chela and 2·8 times as long as deep. Leg iv,: femur (greatest length of

combined subsegments) as long as hand of chela and 3·1 times as long as deep; tibia 3·33 times as long as deep and 1·44 times as long as tarsus; tarsus scarcely longer than fore tarsus and 3·62 times as long as deep.

Measurements (mm.).—Total length (KOH-cleared) 1·67. Abdominal breadth, ·72. Carapace ·557 long, ·473 broad posteriorly, and ·279 broad across eyes. Anterior margin of carapace to anterior furrow, ·265, anterior to posterior furrow, ·202, posterior furrow to posterior margin ·091. Tergal lengths: first, ·074; second ·084; third ·077; fourth ·098; fifth ·118; sixth ·139. Palps: trochanter, ·338×·153; femur ·576×·145; tibia ·568×·171, chela ·810×·237 long and ·195 deep; hand ·460 long; fingers ·390 long. Leg i.: femur (dorsal length of both subsegments) ·346×·113; tibia ·230×·091; tarsus ·195×·070. Leg iv.: femur (greatest length of both subsegments) ·461×·149; tibia ·292×·088; tarsus ·202×·056.

Remarks.—Beier (*l. c.*), in his redescription of this species, does not note the source of his material, but I presume it was Sumatra, in spite of the fact that in his record of the distribution of the species he questions the Sumatran record as doubtful. This is evidently a typographical error, however, since, as previously indicated, Sumatra is the type-locality. At any rate his redescription indicates sixteen teeth in the serrula for both sexes. This agrees with my observations on the single Sumatran male specimen upon which my studies are based and disagrees with With's observations on Simon's Hawaiian specimen where twenty-five were noted. The writer has previously renamed the Hawaiian form primarily on the basis of this difference (*L. cryptus* Chamberlin, *q. v.*).

The palpal proportions herein given are definitely more slender than those given by Beier, in fact approaching those given by him for the Javan species *L. laciniosus*. The differences are insufficient, however, to justify the idea that two species might be involved.

Lophochernes cryptus Chamberlin.

1934. *Lophochernes cryptus* Chamberlin, Bernice P. Bishop Museum, 'Occasional Papers,' x. (22) p. 11.

1905. *Chelifer bifissus* Simon, With. Ann. & Mag. Nat. Hist. (7) xv. p. 98. (misdetermination = *L. cryptus*, sp. n.)

1900. *Chelifer bifissus* E. Simon, 'Fauna Hawaiiensis,' v. 2, pt. 4, p. 517 (misdetermination = *L. cryptus*, sp. n.).

Holotype. Simon's unique specimen (a female) from Olaa, Hawaii, misdetermined and recorded by him as *Chelifer bifissus* Simon (a Sumatran species) and redescribed under the same name by With (*l. c.*). Paris Museum.

Diagnosis.—See With's description cited above.

Remarks.—Although extremly close to true *L. bifissus* in palpal proportions and size, it is my belief that the two species are quite distinct. Thus *L. bifissus* (Simon) has 16–17 teeth in the serrula exterior while With records 25 blades in the serrula of *L. cryptus*. This is a large difference, considering the general constancy of this structure. No other distinct differences can be determined from With's description, and the final status of the species must remain doubtful pending restudy of the type. The differences in palpal proportions stressed by With are in reality non-existent and were evidently due to an error in Simon's original description of *L. bifissus*. The differences in the galea noted by With—*i. e.*, unbranched in the Sumatran specimens, 6-branched in the Hawaiian material—can be readily accounted for as sexual differences.

Reprinted from *The Oxford Magazine*, November 28th, 1935, p. 238.

THE ARACHNIDA. By Theodore H. Savory. Crown Quarto. Pp. xii + 218, with 99 illustrations and 8 plates. (Edward Arnold and Co., London, 1935; 25/- net.)

The preface states that the author's purpose is 'to make a first attempt to give Arachnology something of the unity and status of an individual science that is possessed by Entomology.'

He has produced a lucid and interesting account of the Arachnida, mainly from a morphological standpoint. The second chapter deals with habits and behaviour but we find the latter rather overshadows the former; the author, however, expressly points out that the 'natural history method . . . . is outside the scope of this book,' and presumably for this reason devotes relatively little space to the subject of colouration of spiders. This seems unfair when considerably more space is devoted to the smaller point of the different ways in which Arachnida can rid themselves of a limb. The author, no doubt, felt that the natural history of spiders had been adequately treated in his previous admirable work.

The living Arachnida are divided into twelve orders of which the characters are clearly given in a

chapter devoted to each, and the author is to be congratulated on the success of his attempt 'to secure a more balanced treatment' than has usually been given. Thus the order Ricinulei 'devoted to thirteen species and known to all the world by thirty examples caught in two continents in ninety-seven years,'* which are listed in an excursus to the chapter, receives more attention here than it can ever have received in a work dealing with the whole of the Arachnida.

Successive chapters deal with fossil, extinct, and doubtful Arachnida respectively: to each chapter is appended an 'Excursus,' with some of which we could dispense. Considerable space is taken by a somewhat complicated explanation of why Arachnida are objects of fear: the author says the rapidity of movement induces psychological processes which project the origin of the fear to the rapidly moving animal. But is anyone afraid of a leaf blown along the ground by the wind, to which Mr. Savory's explanation would equally apply? We suggest a simpler explanation: the swiftly moving animals are recognised as hunters. The difference in the feelings of the man-in-the-street towards the carnivorous, swiftly-moving centipede and the heavy, slow, vegetarian millipede is illuminating.

Excursus XI devotes a whole page to the mythical *Gibbocellum* which hardly seems worth while: on the other hand, we should have liked the extremely interesting Excursus IV on the venom of Arachnida to be fuller. A good feature is the map

in each chapter giving the distribution of the order, and we particularly like the line drawings which show very clearly what is intended; but we could not see in Fig. 18 the third, median, smaller claw mentioned in the text. The photographs are indeed excellent, but the frontispiece is too artificial. We found on pp. 10-11 that the Roman characters indicating serial numbers are confusing by not being sufficiently different from the explicatory numbers; and the scheme of notation on p. 140 defeated us.

It is hoped that, before a second edition is printed, the letterpress will be more carefully considered. There is a certain looseness of expression: 'practically without exception' on p. 141 does not look well in a scientific book, nor does the allusion to eyes as 'direct' or 'indirect.' The use of 'Patellas,' 'Tibias,' and 'Retinas' is objectionable. There seems something wrong with the phrase on p. 20, 'a common species with diamond-shaped marks on its femora and bright tawny femora.' Misprints such as 'Chilicera' (p. 98), and 'pastule' (p. 180) call for correction.

These minor blemishes do not prevent us heartily recommending this well-printed and nicely-produced book as a most interesting and comprehensive introduction to the study of Arachnology.

G.D.H.C.

*Since these words were penned it has been pointed out (1935, *Nature*, August 3, 186) that very many more specimens are now known.

(*Reprinted from* NATURE, *Vol.* 141, *page* 807, *May* 7, 1938)

Darwin Misunderstood

Charles Darwin, the Fragmentary Man
By Geoffrey West. Pp. xiii + 351 + 8 plates. (London : George Routledge and Sons, Ltd., 1937.) 15*s*. net.

THE author has evidently spent much time and labour in writing this life of Charles Darwin and presenting it in a moderate-sized volume of 351 pages, printed in a type pleasant to read, with eight illustrations, including three of Darwin (in 1840, 1854 and 1881), one of his wife and three of his ancestors. The list of "works quoted or otherwise utilised" on pages 333–342 is an indication of the ground which was traversed in its preparation, with the fruitful results shown in the excellent choice of significant passages for quotation.

The most unfortunate feature of the book is the word "fragmentary", given prominence in the title but only fully explained at the end, where on page 329 we read—"Werner Sombart has written of 'the fragmentary man' who is the type of the capitalist executive, seeing all in acquisitive terms, subordinating the whole to the part, making the quantitative aspect the total consideration till 'all else within him dries up' and 'everything about him becomes a wilderness, all life dies, all values disappear'." The author then proceeds to his preposterous conclusion : "The resemblance of this 'fragmentary man' to Darwin is evident. The business man lives for the acquisition of wealth ; the Darwinian scientist for the acquisition of knowledge—each irrespective of human consequence."

Nothing in truth could be more unlike the Darwin of whom we know so much and feel that we love, than the type described in Sombart's embittered words—the Darwin who "for nearly forty years . . . never knew one day of the health of ordinary men", and yet in the hours

spared from his scientific researches, had pleasant relationships with his poorer neighbours, taking an interest in their welfare, helping to found a friendly club and acting as its treasurer for thirty years, "keeping its accounts with minute and scrupulous exactness", and explaining the position to its members on Whit-Mondays when he received them in the garden. His friend the vicar wrote of him that in all parish matters he was an active assistant and that his liberal contributions were ever ready. Darwin also acted for some years as a county magistrate, and Major Leonard Darwin informs me that it was during the drive from one of the meetings that the creative thought upon divergence of character suddenly flashed into his mind.

In his "Memories of Down House"*, Major Darwin recalled with especial vividness a walk with his father and sister in a secluded valley beyond the "Sand Walk" at Down House, and how his father, moved by the peaceful beauty of the scene, said "that if he had to live his life over again he would make it a rule to let no day pass without reading a few lines of poetry", quietly adding that he wished he had "not let his mind go to rot so". On this Major Darwin wrote, recording his "firm conviction—a conviction which certainly was shared by all my brothers and sisters—that not only did my father thus give a decidedly erroneous impression of the changes which had taken place in his mind, but that the passages in his autobiography dealing with this subject have been constantly misunderstood and misinterpreted in the Press".

It is right to point out—and I am glad to emphasize it—that the author, again and again throughout the volume, creates an impression of Darwin which is entirely inconsistent with the "fragmentary man" described on page 329, and it is to be hoped that in any future issues the word and its definition will be omitted.

The conclusion conveyed on pages 121, 168 and 276, that Darwin was afraid of his father and

* "Nineteenth Century," July 1929, pp. 118–123. An attempt to explain the misunderstanding referred to in this paragraph was made by the present writer in "Darwin and the 'Origin'", London, 1909, p. 59–66, 79–83, 256–8.

treated him with an exaggerated deference, is not supported by the memories, written about 1877 or 1878, and quoted in the "Life and Letters"†—still less by the preceding paragraphs in which his son Francis records that "Charles Darwin had the strongest feeling of love and respect for his father's memory"; also—"his reverence for him was boundless and most touching"; and his daughter, Mrs. Lichfield, "describes him as saying with the most tender respect, 'I think my father was a little unjust to me when I was young, but afterwards I am thankful to think I became a prime favourite'." She had "a vivid recollection of the expression of happy reverie that accompanied these words, as if he were reviewing the whole relation, and the remembrance left a deep sense of peace and gratitude".

I am indebted to Major Leonard Darwin for the permission to quote the following words from a letter of November 12, 1937: "My memory of my father's attitude to his father was most certainly that he felt the strongest affection and indeed reverence for him. I myself do not remember a hint of any feeling that his father had been 'a little unjust' to him, as stated in my sister's excellent words on the situation." Also, referring to the author's words on page 168 about the purchase of a suitable property and Darwin's "diffidence towards his father in money matters", Major Darwin wrote: "At that date my father could hardly have earned enough to cover his expenses for a month, and all the capital expenditure on Down House must have come from the long and arduous labours of his father. Was it in any way surprising that he wanted to have a say in the matter?" It should be added that Darwin's only living son enjoyed reading the book, and fully appreciates the truthful picture of the exceptionally happy home at Down House.

In addition to the serious mistakes which have been corrected, a few minor errors were noted: "draw" for drawn (p. xii), Christ Church "College"

† Vol. 1, pp. 11–20.

(p. 14), Floreat "Entomologie" (71), "Maderia" (96), "Arachnidæ" (196). F. W. Hope was not the "first Professor of Zoology at Oxford" (71), but founded the chair and nominated J. O. Westwood as its first occupant. It is also to be hoped that the words in which Fitzroy's suicide is described on p. 110 will be modified.

In conclusion, I am anxious to state my belief that the author has done valuable work which will bring comfort to many readers by giving them in a book of moderate size so complete an account of the life of Charles Darwin. E. B. Poulton.

PRINTED IN GREAT BRITAIN BY FISHER, KNIGHT & CO., LTD., ST ALBANS

Reprinted from 'The Entomologist', Vol. LXX, September, 1937, pp. 213–215.

A Catalogue of the African Hesperiidae Indicating the Classification and Nomenclature Adopted in the British Museum. By Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., F.R.Ent.Soc. London: Printed by order of the Trustees of the British Museum, 1937. Pp. xii + 212. With 30 plates.

This is an extremely welcome contribution to orderly knowledge of a difficult and not very popular group. The Keeper of Entomology points out in his preface that it embodies a new classification believed to represent a very considerable advance, and that the correlation of certain Ethiopian and Oriental genera is a new and interesting result. The work commences with a key to genera, followed by a brief diagnosis of each genus, a key to the species in the genus, a synonymic list of species with particulars of subspecies and forms, and a list of material in the British Museum. Publications to which reference is made after the name of the species are cited in the bibliography, which contains 246 items. An appendix gives a list of names formerly applied to certain insects which could not be recognized by the author or belong to insects not African or not Hesperiids, and there is a good index. Seven coloured plates give 116 figures of males of all species described for the first time or of which coloured figures have not previously been published, and 23 other plates give line drawings of the male genitalia of all the species in the British Museum from preparations made by the author according to his "dry system".

The work deals only with the 25,000 specimens in the national collection, in which only two known species are unrepresented. The area concerned is the Ethiopian zoo-geographical region and includes Egypt and Aden. The re-arrangement by Brigadier Evans has resulted in 14 new genera, 66 new species, and 71 new subspecies or forms, with many changes in nomenclature according to International Rules. The usual grouping by subfamilies is avoided by the author who, after discussing the inevitable changes in nomenclature of the 3 subfamilies generally accepted, gathers his genera into 9 groups.

The work maintains—indeed will accentuate—the high reputation of publications from the British Museum: it is beautifully printed and remarkably free from printer's errors. Easily handled and read, it will be a delight to all who, finding Aurivillius' treatment unsatisfactory, will now proceed to work out their collections with its help. A special word of praise is due to the coloured illustrations from drawings by Miss Dorothy Fitchew, which are most excellently reproduced, and in clarity leave nothing to be desired. We note, however, that in the case of *Semalea kola* and *S. scapa* the white dots on the fore wing specified in the text are not apparent in figs. 64 and 65. There is a mistake in the references to the figures of *Gastrochaeta alba* and *G. banda*, which are on Plate 5, and not Plate 4 as stated in the text.

The author repeatedly points out how difficult is the diagnosis by superficial appearances, reference to genitalia being a *sine qua non* with certain genera ; in other cases, as in *Artitropa*, " the early stages have been found to be remarkably different ".

Such information as is given upon distribution is derived entirely from the specimens in the British Museum. Occasional references to distribution of genera and Asiatic affinities (*e. g.* under *Tagiades* and *Celaenorrhinus*) only whet our appetite for more, and we wish the author could have appended to each genus, if not to each species, a note as to whether it occurs outside the Ethiopian region, and its affinities elsewhere.

We wonder why, on p. 188, *Gegenes nostrodamus karsana* and *G. p. pumilio* are included in this work, seeing that every locality cited for them is outside the area comprehended by the survey ?

The author has been forced to devise new names not only for species, but also for genera, and this is the only part of the book on which we cannot wholly congratulate him. Why choose " Gretna " for an African genus ? A certain series of names merely makes use of the letters of the Greek alphabet, and we should prefer to see " lamda " correctly spelt. For other names a geographical tendency is apparent, but it is often misleading, *e. g.* a subspecies of *Sarangesa seineri* coming from the " west shore of L. Tanganyika " is named *tanga*, which certainly suggests a locality from which the insect is not recorded, and the same criticism is applicable to this name in connection with *Metisella trisignatus*. The use of the place-name *haifa* for a new species from Bitje in the Cameroons is another example. Again, *ganda* is rather unfortunate for a species not recorded from Uganda ; for a species described from the Mpanga Forest if *panga* is used it might just as well have been the correct geographical title *mpanga ;* similarly, a species from Chagwe need not have been named *chagwa*.

There are some inaccuracies in the citation of localities, very possibly quoted from incorrectly printed labels. Such are Kokanjero (for Kokonjero) on pp. 70 and 162 ; Toro (for Tero) Forest on pp. 81, 103, 132, 159, 171 ; Bijte (for Bitje) and Kampale (for Kampala) on p. 150 ; Rutchuri and Kabali on p. 175 (the final letters should be u and e respectively). Unyoro is in the western province of Uganda and not in " Kenya " as stated on pp. 123 and 155.

These minor criticisms in no way detract from our admiration of the work as a whole, which forms a thoroughly competent guide for which the need has long been felt. The author is much to be congratulated on the successful result of his labours.

G. D. Hale Carpenter.

August 13*th*, 1937.

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[*From the* QUARTERLY JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY.
Vol. LXIV. No. 276. July, 1938. Pp. 551-552.]

Nature study above and below the surface. A bridge between amateur and professional. By H. C. GUNTON, F.R.Ent.S., F.R.Met.S. With a preface by Dr. C. B. WILLIAMS, M.A., D.Sc. Demy 8vo., Pp. 134, 18 illus., London (H. F. & G. Witherby, Ltd.), 1938. Price 7s. 6d.

We welcome this original book because it attempts to direct the work of the beginner and experienced amateur naturalist into useful channels and stresses the need for collaboration and systematic records. In spite of its comprehensive title it is concerned chiefly with insects, devoting little space to other organisms, but ably summarising much recent work in the many fields of entomology. By far the best section is that discussing phenology, on which subject the author is an acknowledged expert. Indeed, it is largely due to his efforts that the list of phenomena considered by phenologists has been carefully revised in recent years in order to eliminate errors and to make possible a more complete analysis of the records so that a clear understanding of the inter-relationship of periodic events and meteorological conditions seems in sight. The book is clearly written and very readable, but although generally accurate, includes several errors and misleading statements. Scientific names are not invariably distinguished by the use of italic type, the year of publication and exact page citations are not given consistently in every reference, and there is no index. A common mistake concerning the binomial system of nomenclature is repeated on page 17. As Sherborn and Tams point out (1938, *J. Soc. Bibl. Nat. Hist.*, **1**, 130) in *Felis leo, Felis* is the generic name, *leo* the trivial name and *Felis leo* the specific name. Only two generations of the small white butterfly are mentioned on page 22, whereas Richards (1934, *Proc. R. Ent. Soc. Lond.*, **9**, 78) has shown that there are three broods of this species in southern England. The construction of the penultimate paragraph on page 24 suggests that an aquatic stage is a primitive feature of insects, a belief no longer tenable (vide Miall, 1895, *The natural history of aquatic insects*, 3-6). The diagram on page 25 might be interpreted to mean that the insects are derived from the spiders through the centipedes, and in the same figure the assignment of dragonflies to the order Neuroptera is the classification of a past decade. The statements on pages 29 and 39 that Lepidoptera feed on pollen could only be true of mandibulate forms such as *Micropteryx* and surely nectar is meant. The shark moth mentioned on page 56 as resembling a splinter of wood is best treated as an example of special resemblance and should be transferred to section *b* of the classificatory scheme although admittedly, as a border line case, it could be put in either category. General protective resemblance "is chiefly found among the animals inhabiting some uniformly coloured expanse of the terrestrial surface, such as an ocean or desert" (Poulton, 1908, *Essays on evolution*, 297). Among misprints are the following: p. 19, *Nomenclatur* for *Nomenclator*; p. 31, *phleas* for *phlœas, Nymphauds* for *Nymphalids*, *paleacia* for *paleacea*; p. 34, *rupricapraria* for *rupicapraria*, *leucophiaria* for *leucophearia*; p. 48, *Geomatrœ* for *Geometrœ*; p. 50, *dilulata* for *dilutata*; p. 53, *Orgya* for *Orgyia*; p. 83, *Bombyxmori* for *Bombyx mori*; p. 92, *cuereus* for *quercus*; p. 101, *Cinnibar* for *Cinnabar*; p. 122, *boil* for *boll*; p. 127, *Ephesia* for *Ephestia*. On p. 31 there is no entry against No. 34, nor against Michaelmas Daisy. These points, however, detract but little from a highly interesting account of recent progress in the study of entomology which can be recommended as a useful addition to the bookshelves of any naturalist.

B.M.H.

Extracted from the Proceedings of the Bournemouth Natural Science Society, 1938 (Vol. XXX).

Presidential Address, 1938.

Mimicry in relation to other forms of Protective Coloration.

By PROFESSOR G. D. HALE CARPENTER, M.B.E., D.M., F.L.S., F.R.E.S., ETC.

The subject of Mimicry will here be discussed only as it affects insects, in which it has chiefly been studied. As now used the term does not include the "Protective Mimicry" of travellers, which will be described later; it is used for the deceptive resemblance of one animal to another. My object, however, is to show that these two classes of cases are essentially similar, and both explicable on the theory of Natural Selection acting upon variations presented to it. Many difficulties are cleared away if this very essential point is remembered; too often Mimicry between insects is looked upon as a highly peculiar and specialised phenomenon invented by "Arm-chair philosophers" to explain a few cases of resemblance between insects, etc.

The use of the convenient term Mimicry requires a caution, for in common parlance it means the conscious assumption of characteristics peculiar to one individual by another. No consciousness of this kind can be attributed to an insect; it is entirely passive material in the hands of Heredity, Variation, and Natural Selection.

The colours of insects are, broadly, either concealing or revealing. Conspicuous insects are, for obvious reasons, those most often found by travellers, but concealing coloration is far more usual. It can be either General or Special, the former implying resemblance to the general appearance of surroundings as a whole (dark or light mice), the latter a detailed resemblance to a particular part of the environment (leaf insect or stick caterpillar).

The term Special Procrypsis is used for these detailed resemblances which, as will be shown, are paralleled by true Mimicry. All protective resemblances are greatly accentuated by attitudes which often involve quite special and unusual habits, and it cannot be overemphasised that they are affairs of life and not of cabinet specimens.

Sometimes Special Procrypsis results in resemblance to highly specialized parts of the environment, as when a moth closely resembles a bird-dropping, an object of no interest to an insectivorous enemy. It is quite a small step from this to resemblance to another object known by previous experience to be distasteful or harmful.

Review.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiv.

'THE BRITISH MOSQUITOES.' By J. F. MARSHALL, C.B.E., M.A., F.R.E.S., Director, British Mosquito Control Institute, Hayling Island, Hants. London: Printed by order of the Trustees of the British Museum. Pp. xii + 341, 172 figs., 20 pls. (9 coloured). Issued 23rd July, 1938. Price £1.

It is the lot of a well-defined group of insects of economic importance to receive such intensive study that the knowledge of the fundamental features of their morphology, life-history and development grows apace. This is well shown in the degree of completeness and the general high level of excellence in the volume now before us. Indeed, as regards the so-called mosquitoes, few, if any, other groups of British insects can be so thoroughly known that it would be possible to construct keys not only to the adult forms, but also to their hypopygia, first instar and the later stages of larvae and the pupae.

The work is richly illustrated in colour, photogravure and line-blocks, and many of the drawings are by the master-hand of Terzi. Its style is remarkably clear and concise, although there are, perhaps, too many footnotes. The keys, so far as they have been tested, work well, but the inclusion of page-references to the more detailed descriptions would have been an advantage. Of the twelve chapters, the first three are introductory, while the next contains a detailed account of the stages of development of a mosquito. The four following sections enable the reader to distinguish the various species, and give a summary of all important information available concerning them, including an interesting account of the two species until recently confused under the name of *Culex pipiens*, one of which is a man-biter and the other is not. Chapter 9 describes the present position of 'mosquito control' in Britain, where they may fortunately be regarded as a nuisance rather than as serious carriers of disease. Chapter 10 is concerned with bionomic problems such as feeding, oviposition, swarming, range of flight, etc., and ends with a discussion of the almost complete disappearance of malaria in Britain, concluding that this is due to the amelioration of

living conditions which has destroyed the intimate association between man and the race of *Anopheles maculipennis* hibernating in warm houses or stables. The last two chapters comprise a bibliography of over two hundred references and a detailed index, unfortunately sub-divided into three sections.

British Dipterists have long awaited this book, but now that it has at last appeared they will agree that it has been worth waiting for, and reflects much credit upon all concerned in its preparation.—B.M.H.

[*Extracted from the* PROCEEDINGS *of* THE LINNEAN SOCIETY OF LONDON, Session 149, 1936–37, Pt. 4, 3 *November* 1937.]

OBITUARY NOTICE.

ROBIN JOHN TILLYARD died in New South Wales on 13 January 1937, after a motor accident.

This tragedy removed from the field of zoology, and entomology in particular, one of its most brilliant devotees, whose loss will be felt particularly in Australia and New Zealand.

He was born in Norwich on 31 January 1881, the son of Mr. J. J. Tillyard. He went to Dover College, whence he passed high on the list into the Royal Military Academy,

but was, fortunately for biology, rejected for rheumatism. Having won scholarships for classics at Oxford and mathematics at Cambridge he selected the latter, and took his degree from Queens' College as a Senior Optime in the mathematical tripos of 1903.

It is interesting to reflect how small a part mathematics played in his subsequent career: had he been born a little later it is possible that the rapidly developing school of mathematical biology might have claimed his attention, and field entomology and palaeontology would have been the poorer. He read oriental languages and theology in his fourth year at Cambridge, but was forced by rheumatism to leave England and became mathematical master at Sydney Grammar School: this post he resigned in 1913 and worked for a science degree in the University.

His life was endangered by a railway accident shortly before the outbreak of war, but after two years he was able to continue his studies and received in 1914 the first B.Sc. given by the University, which in 1915 appointed him lecturer in zoology, after being a Linnean Macleay Fellow.

The Linnean Society of London awarded him the Crisp prize and medal in 1917. His growing reputation as an entomologist skilled in field-work as well as in the morphological aspects of the science resulted in his appointment in 1920 as the first chief of the Department of Biology in the newly established Cawthron Institute of Scientific Research, Nelson, New Zealand. Here he came to the fore in the work of practical control of insect pests, and in 1925 received the high honour of election to the Royal Society. The directorship of the Institute followed, in 1926, and he was awarded the Trueman Wood medal of the Royal Society of Arts and Sciences of London. Both Sydney and Cambridge Universities conferred upon him the doctorate of science, and his old college, Queens', made him an honorary fellow. Two years later he returned to Australia as Chief Entomologist to the Commonwealth, but was forced by ill-health to resign in 1934 and remained in Canberra. The Royal Society of Tasmania honoured him with the R. M. Johnston Memorial Medal in 1929; the Clarke Memorial Medal was awarded in 1931 by the Royal Society of New South Wales, and in 1935 he received the Mueller memorial medal.

He was a Fellow of the Royal Entomological Society of London, the Royal Society of New Zealand, and the Geological Society of London, a corresponding member of the Zoological Society of London, and an honorary member of the Entomological Societies of Belgium and America.

His eminence in the study of the phylogeny of insects resulted in his aid being sought in work upon both recent and

fossil specimens, necessitating three visits to Europe and five to America.

He married in 1909 Patricia Craske, M.A., daughter of Mr. W. J. Craske of Borstal, Rochester, who survives him with four daughters. Only those who knew his private life can say how much he, and science, owed to his wife's devoted care through his periods of ill-health, and to her sympathetic help in the work, for which she often prepared illustrations.

Like many another genius with active imagination he fell under the spell of the realm of the unseen world in which he became deeply interested. At the funeral oration at Canberra it was said 'He sought passionately for some great purpose running like a golden thread throughout the phenomena of the Universe . . . For him belief in God was the driving force of his life . . . it led him to service in many spheres, scientific, academic, cultural, and religious . . . above all it gave him such an assurance of the eternal survival of personality that the inevitable fact of death had for him no terrors."

Tillyard's scientific publications numbered about 180, including three books; they commenced in 1905 and ended with a letter to 'Nature' appearing in the issue of 9 January 1937, so quickly followed by his death that he could not have seen it. Very many of his papers were published by the Linnean Society of New South Wales. His works may be grouped under five heads:—

1. *General Entomology.*—The outstanding works are two books: 'The Biology of Dragon-flies' (Cambridge, 1916) and 'Insects of Australia and New Zealand' (Sydney, 1926). The former dealt very completely with the biology of the group that was his first love and on which his first published paper was written; it will long remain a standard. The life-histories of dragon-flies always interested him, and he was the first to work out the details of many: he pointed out that the adaptations to aquatic life in the larvae cannot be equalled among other insects. His 'Insects of Australia and New Zealand' is another work likely to remain a standard text-book of entomology for students in those countries and of great value to entomologists in general. In both these works especial attention is paid to the light thrown on phylogeny by palaeontology. Although so eminent a field naturalist Tillyard was not greatly interested in the workings of selection, and wrote little on such questions as food preferences of insects or their enemies, the defensive value of coloration, or sexual selection. The distribution of species, especially in connexion with the fauna of Australia and New Zealand, greatly interested him, and in 1914 he proposed a method of plotting distribution by 'specific contours' which would reveal areas of present greatest density of any group as 'zoo-centres', showing by

the shape of the contour whether any group had originated in an area or invaded it from outside and subsequently differentiated therein. He found support in the distribution of archaic insects of several orders for Hedley's theory of an Antarctic continent linking Tasmania and South-eastern Australia, New Zealand, and South America.

The archaic types of Odonata, Mecoptera, and Neuroptera still surviving in Australia received much attention from Tillyard, who took care, however, to point out that forms are not necessarily archaic because they are confined to Australia.

2. *Morphological and Phylogenetic.*—Although he left no order of insects entirely unstudied his chief work was among the orders Odonata, Ephemeroptera or Plectoptera, Neuroptera, Mecoptera, and Trichoptera. Life-histories were found to be of much phylogenetic significance. The primitive moths ascribed by Crampton to the Trichoptera (Micropterygoidea) were shown to be true Lepidoptera, but, with a few others, separated from the vast majority by the similarity of venation in all the wings.

The characteristic rectal respiratory mechanism of dragonfly larvae was minutely studied and the various forms of 'branchial basket' classified in evolutionary sequence. Tillyard was the first to show that the tracheae, when the larva leaves the egg, are filled with fluid which is gradually displaced by carbon dioxide secreted by the lining membrane, and that not until then does rectal respiration commence. He became an authority on the question of wing-venation and claimed that, with the aid of fossils and archaic survivals, he had established a complete phylogeny of the venation of dragon-flies. The Neuroptera (Lace-wings, Ant-lions, &c) provided equally attractive material. The life-history of *Ithone* was revealed as of possible economic value, 'but it took many years to work out without any thought that the results might even prove of economic value. There could scarcely be a better illustration of the value of pure research in Entomology than this'.

But it was the order Mecoptera (Scorpion-flies) which attracted him most in his later years. This, now represented by a comparatively few species in Australia, is noteworthy for the number of forms of archaic type such as *Nannochorista*, which has come down, almost unaltered, from Permian times.

Intensive study of the relationships of Mecoptera led him in 1918 to formulate his highly important classification of the majority of insects with complete metamorphosis as the 'Panorpoid complex' or the Mecopteroid orders; all except Coleoptera and Hymenoptera have been derived from ancestral Permian Mecopteroid forms. This implies that the evolution

of the pupal stage took place three times as a response to the marked change of climate in Permian times ; for the whole ancestral Mecopteroid complex, for the Coleoptera, and for the Hymenoptera. The larva responded to the increased drought by going underground and shortening the later instars by a single metamorphosis.

3. *Palaeontology.*—Tillyard especially delighted in discovering the secrets of geology, and two extremely important fossil faunas in the Permian of Kansas and the Permian and Triassic of Queensland and New South Wales added very greatly in his hands to knowledge of the ancestry of living insects. The history of the Panorpoid Complex was made clear by new orders such as Protomecoptera, Paratrichoptera, Paramecoptera (including the extremely significant *Belmontia*), and the family Permochoristidae, from which the present-day Nannochoristidae scarcely depart : these were the earliest known Holometabolous insects. Thanks to Tillyard the past history of Mecopteroid insects is as completely known as that of any group of animals from Upper Carboniferous to present day. Other groups described were the Protohymenoptera, for which his claim that they are ancestral to Hymenoptera is much disputed, and Protocoleoptera, doubtfully direct ancestors to beetles.

The Protodonata, considered by Tillyard, but not by all experts, to belong to the Megasecoptera, were described as a side line not leading directly to modern dragon-flies whose ancestry is traced through such significant forms as *Brodicia*, a Megasecopteron from upper Carboniferous, and *Kennedya* from the Kansas Permian, the first true Odonate.

It must have been exceedingly satisfactory to Tillyard to be able to adduce, in 1937, final evidence for his statement in 1921 that living Australian Mecoptera (Nannochoristidae) represent ancestral Diptera : he called them '4-winged Diptera'. In 1929 he described certain fossils from the Permian of Warner's Bay, New South Wales, as bringing the orders Paratrichoptera and Paramecoptera within the scope of Mecoptera : among them was a unique specimen, *Permotipula*, which he claimed as the origin of Diptera through such forms as *Tipula*, the 'Daddy-long-legs'. It was undoubtedly dipterous, but being an incomplete specimen it was not possible to say whether it had two or four wings. However, in his last publication ('Nature', 9 January 1937) Tillyard was able to show that his forecast was correct, for he found in a new fossil for which the group Protodiptera was devised a further specialized Paratrichopteron with four wings, but venation closely resembling that of a present-day family of flies, and showing definite reduction of the metathorax, a stage in the process by which a 4-winged fly could be reduced to a Dipteron.

Tillyard's third book, published in Sydney, 1936, in conjunction with the late Sir Edgeworth David, dealt with certain appearances in late Pre-Cambrian rocks of South Australia. His imaginative interpretation of these, however, as representing a new class of Arthropoda, Arthrocephala, is not accepted by many naturalists.

4. *Evolution of Insects.*—Tillyard's genius found plenty of scope in tracing the evolution of modern insects, and in 1930 he published a new theory of the evolution of insects as a whole.

Strenuously combating the theory that insects had evolved from Crustacea he stressed their relation to Myriapoda, suggesting that both classes had arisen from a primitive type 'Protaptera' with four segments. The chief merit of this theory was that it ingeniously overcame the difficulty of the varying position of the gonopore in the two classes. The processes of segmentation were discussed and anamorphosis called into play: specialized forms are epimorphic while Collembola retain the original protomorphic form. This theory, involving segmental gonads in the ancestor, was much criticised, and in 1935 Tillyard replaced it: he suggested that an original protomorph with only four post-cephalic segments added further segments by anamorphosis, and according to whether interpolation took place anterior or posterior to the original gonad-bearing segment so the resulting descendants were opistho- or pro-goneate.

Tillyard early supported the view that the fragments of Arthropod jaws described as *Rhyniella* from Devonian strata came from genuine Collembola: this view, subsequently proved by discovery of more complete and undoubted remains of this order, finally disposes of Handlirsch's theory that Apterygote insects are degenerate descendants of the Pterygota. It is noteworthy that nowhere could Tillyard find any evidence of the origin of wings, which he considered must have taken place at least as far back as Lower Carboniferous times.

5. *Economic Entomology.*—Tillyard was in the forefront of economic work. In 1920 he advised on the problem of maintaining an adequate supply of natural food for the trout which, introduced into mountain streams, had overrun their food supply. His work on the life-history of *Ithone* led him to try the employment of its larvae to destroy in other countries the larvæ of beetles which devour grass-roots. In 1921 he was responsible for the introduction into New Zealand, and later into Australia, of the parasite of the Woolly Aphis of apple-trees, which was attended with great success. Other pests were also attacked by natural enemies with varying success. The closely linked, but

inversely related, work of combating introduced plant pests by the insects which attack them in their native land found in Tillyard an ardent advocate. In 1926 he visited England to study insects feeding upon Blackberry, Furze, Ragwort, and St. John's Wort, all of which had become a menace to New Zealand: in the case of Ragwort sufficient enemies were found to make it appear possible that control by natural means held a fair prospect of success: the work is being carried on at the present time. G. D. HALE CARPENTER.

The conspicuous insects so easily collected in the field have a number of characteristics in common; bright and easily distinguished colours in simple patterns, slow flight, free exposure and unafraid demeanour; they are often gregarious, thereby increasing their conspicuousness. Tested on animals they are found to be relatively distasteful as compared with procryptic insects, and often to give off an offensive odour, or to have stings or poisonous hairs. The coloration is said to be "Warning," or Aposematic; its simplicity enables it to be remembered by an inexperienced enemy, while toughness and pliability allow the insect to be examined and perhaps pulled about or licked without incurring serious damage. A young animal that has once handled a wasp and been stung by it remembers afterwards the black and yellow rings and will leave alone another insect similarly coloured if he can get enough food of other kinds.

Warning colours are often associated with special habits, as in certain grasshoppers which, when alarmed, stand quite still, display bright colours on wings or body, and may emit brightly coloured acrid bubbles of froth. Attitude is as important for Aposematic as for Procryptic colours, but with the opposite purpose.

It has been found that a simple type of warning coloration may be shown by large numbers of insects of many different families; this is known as Syn-aposematic coloration, and is based on the fact that experimental tasting by inexperienced enemies leads to loss of life by any one species which is avoided if the enemy has fewer aposematic patterns to learn. In other words, A and B, instead of each having its own pattern, will both benefit if they can, through selection of heritable variations, be made so like each other that any enemy that has found A to be distasteful will avoid B, and vice versa. This may be illustrated by different firms, all producing good stuff, agreeing to use a common trade-mark; it was first explained by Müller and is sometimes known as Müllerian Mimicry, though, as it does not involve deceit, the term mimicry does not apply

Experimental evidence is available to show that aposematic insects *are* considered relatively distasteful, and that procryptic colours actually do conceal their wearers under natural conditions, but also that edibility depends upon degree, and that very few insects will be inedible to all enemies under all conditions.

When Bates, a few years after the publication of "The Origin of Species," put forward the theory that certain insects have, through the operation of Natural Selection, come to acquire a superficial resemblance to others belonging to what we have described as Aposematic species, this theory of Mimicry caused a great sensation. It depends firstly on the principle of Warning Colours, and requires that variations in colour and pattern which appeared in some insect of truly edible type resulted in its being

Report of the Hope Professor of Zoology (Entomology) for the year ending 31 July 1935

Staff

Professor: G. D. Hale Carpenter, D.M., Fellow of Jesus College.
Assistant (part time) for Orthoptera: R. Hanitsch, Hon. M.A.

Lectures and Laboratory Instruction

No formal lectures or laboratory instruction have been given: the collections are frequently consulted, and help sought, by members of the University actively interested in Entomology.

Research and Publications

Dr. B. M. Hobby, D.Phil., while holding a Junior Research Fellowship at Queen's College, has continued his researches on predacious insects and their prey, and has commenced work on the insects collected by the University expedition to Borneo.

Mr. J. Ford, B.A. (New College), has been working on collections made by him in Uganda, and commenced an investigation on the dynamics of a population of the flour beetle (*Tribolium confusum* Duval).

Mr. J. H. Cook, B.A. (Merton), has been conducting a research for a B.Sc. thesis on the biology of *Calosoma inquisitor* Linn. and *Silpha* (*Xylodrepa*) *quadripunctata* Linn., two predatory forest beetles.

The following publications during the year under review arise from, or concern, the work of the department: (specimens) means that the specimens concerned were presented to the department. Abbreviations for oft-recurring titles are as follows:

Proc. or *Trans. The Proceedings* or *Transactions of the Royal Entomological Society of London.*

E.M.M. The Entomologist's Monthly Magazine.

Brit. J. or *Brit. Tr. The Journal* or *Transactions of the Society for British Entomology.*

The initials 'E.B.P.' or 'G.D.H.C.' in brackets after the name of the author signify that the observations or notes were communicated, or the subject of comment, by the Emeritus Professor or the Professor.

Of General Interest

Andrewes, H. L. (E.B.P.). 'Abnormal epigamic behaviour of a male *Aglais urticae* L' (*Proc. 9*, 105).

Arnold, E. L. (E.B.P.). 'Butterflies attacked by bee-eaters in S.W. India: protective devices of caterpillar and associated Phytophagous beetle' (*Proc. 9*, 74–5).

Benson, R. B. '*Bembex regnata* Parker, preying on butterflies' (*Proc. 9*, 75–6).

Brindley, Mrs. M. D. 'Comments on the discussion on "Protective adaptations of animals"' (*Proc. 9*, 39–40); (E.B.P.) 'Swallows capturing butterflies, coots swallowing Pentatomids, sparrows feeding young on cuckoo-spit' (*Proc. 9*, 68–70); (E.B.P.) 'Resemblance of a Capsid to an ant' (*Proc. 9*, 91–2).

Bucknill, E. G. (E.B.P.). 'Notes on Japanese insects and their enemies' (*Proc. 10*, 29).

Chorley, T. W. (G.D.H.C.). 'Mimics and parasites of the honey-bee in Africa' (*Proc. 9*, 87–9), specimens.

Collenette, C. L. (G.D.H.C.). 'Notes concerning attacks by British birds on butterflies' (*Proc. Zool. Soc. Lond.*, 1935, 201–17).

Collins, J. (E.B.P.). Lepidopterous larvae accepted or refused by a Pentatomid (*Proc. 9*, 85), specimens.

Cott, H. B. (E.B.P.). 'Warning colours and Mimicry: a reply to Dr. McAtee' (*Proc. 9*, 109–19).

Evans, G. H. (E.B.P.). Bees visiting orchids (*Proc. 9*, 82–3).

Fisher, R. A. (E.B.P.). 'Viceroy' butterfly mistaken for its model (*Proc. 9*, 97).

Kenway, H. C. (E.B.P.). Notes on South African *Charaxes*, &c. (*Proc. 9*, 103–4).

Lamborn, W. A. (E.B.P.). Lepidopterous larvae in Termitaria, &c. (*Proc. 10*, 3–4), specimens. Distastefulness of an aposematic grasshopper (*Zonoceros*) (*Proc. 10*, 4–5).

Latter, O. H., and Eltringham, E. Epigamic behaviour of *Euploea core asela* Moore (*Proc. Roy. Soc.* B, *117*, 470–82).

Morton-Jones, F. (E.B.P.). Bird-feeding experiments; the 17-year Cicada; &c. (*Proc. 9*, 80–2); 'Further experiments on coloration and relative acceptability of insects to birds' (*Trans. 82*, 443–53).

Myers, J. G. 'Nesting associations of birds with social insects' (*Trans. 83*, 11–22); (E.B.P.) Resemblance of a New Zealand leaf-hopper to its food-plant (*Proc. 9*, 83); (E.B.P.) 'Observations on *Laternaria*' (*Proc. 9*, 83–4); (E.B.P.) 'Experiments with spiders and the bee-like *Eristalis tenax* Linn.' (*Proc. 9*, 93–4); (E.B.P.) A Reduviid mimicking a Braconid, an Asilid mimicking a bee, in British Guiana (*Proc. 9*, 95–6), specimens; (E.B.P.) 'An aboriginal folk-tale based on the bird and wasp nesting association' (*Proc. 9*, 96–7).

Nash, T. A. M. (E.B.P.). Myiasis of Flamboyant tree (*Proc. 10*, 21–2).

Oehlenschlaeger, Miss (E.B.P.). Arctiid moth refused by a martin (*Proc. 10*, 29).

Peile, H. D. (E.B.P.). Procryptic and mimetic resemblances in N.W. Himalayan insects (*Proc. 9*, 92–3).

Poulton, Sir E. B. 'The power of changing colour as a form of protective resemblance' (*The South-Eastern Naturalist and Antiquary*, *39*, 98–109); Attacks of birds on butterflies in Britain (*Proc. 9*, 70–1); in U.S.A. (*Proc. 9*, 74), specimens in some cases; Attacks of wasps on butterflies (*Proc. 9*, 71–2), specimens; Observations on a Thomisid spider and its prey' (*Proc. 9*, 72–4), specimens; The 'homing' of a female moth (*Proc. 9*, 82); Assemblages of Coccinellid beetles, and of *Danaus plexippus* Linn. (*Proc. 9*, 108–9); Mimicry of a pair of Thynnidae by a Mydaid (*Proc. 10*, 21–2), specimens.

The Professor. 'Mimicry' (*School Science Review*, No. 62, 228–35); 'Attacks of birds upon butterflies' (*Nature*, *135*, 194), specimens; 'Mimikry' (*Ent. Rundschau*, *52*, 20–4, 37–9, 50–3); Selective attacks of birds on butterflies (*Proc. Linn. Soc. Lond. 1934–5* (3), 51); 'Attacks of birds upon butterflies in the

Solomon Isles' (*Proc.* *9*, 79), specimens; 'Further examples of attacks of birds upon butterflies' (*Proc.* *9*, 90–1), specimens; 'A Mantis preying on a Sphingid' (*Proc.* *9*, 103), specimens; 'A migrating Hesperid' (*loc. cit.*), specimens; Three documents relating to the history of the Entomological Society of London (*Proc.* *10*, 2–3).

Simes, J. A. Observations on butterflies and their enemies in south-eastern France (*Proc.* *9*, 64–5).

The following authors contributed to a joint reply (*Proc.* *9*, 21–39) to Dr. W. L. McAtee's rejoinder (*Proc.* *8*, 113–26) to papers on Protective Adaptations (*Proc.* *7*, 79–105), and the controversy was terminated by the Emeritus Professor (*Proc.*, *9*, 119–20): Brindley, (Mrs.) M. D.; Cott, H. B.; Donisthorpe, H. St. J. K.; Fisher, R. A.; Hodson, (Mrs.) C. B. S.; Marshall, Sir Guy; Morton-Jones, F.; Oehlenschlager, Miss E. A.; the Emeritus Professor. In this connexion see also Cott and Brindley, above.

Palaearctic Region

Ford. E. B. The first record of *Argynnis maia* Cramer in England (*Proc.* *9*, 106–7).

Freeman, J. R. 'Prey of *Aeshna cyanea* (Odon.) Müll.', specimens (*Brit. J.* *1*, 35).

Hobby, B. M. '*Eutolmus rufibarbis* Mg. (Dipt. Asilidae); the prey of dragon-flies' (*E.M.M.* *70*, 191), specimens; 'Notes on predacious Anthomyiidae and Cordyluridae (Dipt.)' (*E.M.M.* *70*, 185–90), specimens; 'Predacious Diptera and their prey' (*Brit. J.* *1*, 35), specimens.

Hobby, B. M., and Elton, C. 'Mortality in the dung-fly *Scatophaga stercoraria* L.' (*Brit. J.* *1*, 71–2).

Killington, F. J. 'On the life-histories of some British Hemerobiidae (Neur.)' (*Brit. Tr.* *1*, 119–34).

Poulton, E. B., Hobby, B. M., Hemming, F., Edelsten, H. M. William Jones, and the names of British Lepidoptera used in the 18th century (*Brit. Tr.* *1*, 139–84).

Poulton, E. B. 'An early appearance of *Colias croceus* Fourc.' (*E.M.M.* *71*, 51).

Scott, H. Puparium of Nycteribiidae (*E.M.M.* *70*, 255–9).

Spooner, G. M. Dipterous prey of *Metacrabro quadricinctus* F. (*Brit. J.* *1*, 48–53), specimens.

Taylor, E. 'Woodlice of the Oxford district' (*Report of the Ashmolean Natural History Society of Oxfordshire for 1934*, 19–22), specimens.

Walker, J. J. '*Limenitis camilla* (*sibylla*) &c., in Oxford' (*E.M.M.* *70*, 191).

Ethiopian Region

Hanitsch, R. 'On some Blattids from the French Sudan' (*Bulletin de la Société des Sciences naturelles du Maroc*, *14*, Nos. 7–8, 4 pp., specimens.

Hobby, B. M. 'New African Asilidae' (*E.M.M.* *70*, 234–9), specimens; Rhodesian Asilidae and their prey (*Journal of Animal Ecology*, *4*, 90–112), specimens.

Poulton, Sir E. B. Foodplant of *Cymothoë coenis* Drury (*Proc.* *10*, 3).

The Professor. '*Acraea rahira* Boisd. from Uganda' (*Proc.* *9*, 64), specimens; 'An association of black and white butterflies from Mt. Mlanje, Nyasaland' (*Proc.* *9*, 79–80), specimens; Butterflies from the Sudan-Congo border (*Proc.* *9*, 89–90), specimens; A new form of *Acraea althoffi* Dew. (*Proc.* *10*, 22–3), specimens; 'A rare form of *Belenois thysa* Hopff.' (*Proc.* *10*, 31–2), specimens.

Talbot, G. New species and forms of African Lycaenidae (*E.M.M.* *71*, 69–78, 115–27, 147–53), specimens.

Other Regions

Edwards, F. W. 'New *Megarhinus* from Borneo' (*Annals and Magazine of Natural History* (10), *15*, 579–81).

Hanitsch, R. 'New Blattids from Celebes' (Stylops, *4*, 14–19), specimens; 'Blattidae' (*Wissenschaftliche Ergebnisse d. Nieder. Expedition in d. Karakorum*, 1922–30, by Dr. Ph. C. Visser. Zoologie, 213–14), specimen.

Poulton, Sir E. B., and Riley, N. D. Butterflies from the Marquesas (*Pacific Entomological Survey*, Publication 7, article 24, pp. 299–303).

The Professor. All-female families of *Hypolimnas bolina* L. (*Proc. 10*, 32–3), specimens.

THE LIBRARY

There has been no change in the serials systematically taken, nor have any new periodicals been commenced. Numbers of separates are received from institutions to which the bound volumes of Hope Reports are sent: a valuable addition thus received in exchange is the first volume of *Travaux du Laboratoire d'Entomologie, Paris*, issued in 1933; other volumes have been promised as they appear. The new *Manual of Mycology* by Townsend, published in Brazil, is being subscribed for, and the first part has been received. The executors of the late Dr. F. A. Dixey, F.R.S., kindly presented a large number of separates and some 30 books from his library, among which the following are especially noteworthy:

Baldwin, J. M. *Development and Evolution* and *Darwin and the Humanities.*

Forel, A. *The Senses of Insects* (translated by Macleod Yearsley).

Huxley, T. H. *On Our Knowledge of the Cause of the Phenomena of Organic Nature* (6 lectures to working men).

Réaumur, R. A. F. de. *The Natural History of Ants* (translation by W. M. Wheeler of an unpublished MS., 1926).

Waterhouse, G. A., and Lyell, Geo. *The Butterflies of Australia.*

A gift of considerable value by Mr. Hy. Turner is best described in his own words: 'A photographic copy of Hübner's 1808 pamphlet which was the trial proof, I take it, of the 1818 volume "Sammlung exotischer Schmetterlinge". It consists of the first 8 pages which, when published in the latter, were slightly altered. I only know of one original and that is in the museum at Berlin Dahlem under Dr. Horn.'

The department possesses so much of the collections, writings, and sketches of W. J. Burchell that a drawing of him in Rio, 1825–30, by his grandmother Esther Fry, which was generously given by Sir Henry Miers, F.R.S., in December, is all the more valuable. It was presented through the Emeritus Professor, who has shown such great interest in keeping together at Oxford the records of this great traveller.

The following are the more important accessions to the library, the donor, or the fact of purchase, being stated in brackets:

Aldrich, J. M. *Diptera of Patagonia and South Chile*, Pt. 7, Fasc. 1. Tachinidae. (Trustees of the British Museum.)

Becker, Th. *Revision der Loew'schen Diptera Asilica in Linnaea Entomologica 1848–49*. (Purchased.)

Brauer, A. *Die Süsswasserfauna Deutschlands*. (Purchased.)

Carr, J. W. *The Invertebrate Fauna of Nottinghamshire* (*supplement*). (Author.)

Edwards, F. W., and others. *Diptera of Patagonia and South Chile*, Pt. 6, Fasc. 3, Ephydridae, Syrphidae, Conopidae. (Trustees of the British Museum.)

Ferris, G. F. *The Principles of Systematic Entomology*. (Purchased.)

Fisher, A. K. *The Economic Value of Predaceous Birds and Mammals*. (Purchased.)

Fraser, F. C. *Fauna of British India*, *Odonata*, Vol. II. (The India Office.)

Halbert, J. N. *List of the Irish Hemiptera*. (Dr. Malcolm Burr.)

Hudson, G. V. *New Zealand Beetles and their Larvae*. (Commander J. J. Walker.)

Janse, A. J. T. *The Moths of South Africa*, Vol. II. (Author.)

Karl, O. *Die Tierwelt Deutschlands—Muscidae*. (Purchased.)

Kellogg, Vernon. *Insects*. (Emeritus Professor.)

Lindroth, C. *Die Insektenfauna Islands und ihre Probleme.* (Commander J. J. Walker.)

MacGillivray, A. D. *External Insect Anatomy.* (Purchased.)

Malloch, J. R. *Diptera of Patagonia and South Chile*, Pt. 6, Fasc. 4 and 5. Acalyptrata. (Trustees of the British Museum.) *Insects of Samoa*, Pt. 6, Diptera, Fasc. 3. (Trustees of the British Museum.)

Osborn, H. *Insects of Samoa*, Pt. 2, Hemiptera, Fasc. 4. (Trustees of the British Museum.)

Parshley, H. M. *A Bibliography of the N. American Hemiptera-Heteroptera.* (Commander J. J. Walker.)

Ramme, Willy. *Afrikanische Acrididae.* (Dr. Malcolm Burr.)

Savory, T. H. *The Spiders and Allied Orders of the British Isles.* (Purchased.)

South, R. *The Moths of the British Isles.* (Purchased.)

Sundry authors. *Greenland and Spitsbergen Papers*, 1934. (O.U. Exploration Club.)

Van Someren, V. G. L., and Rogers, K. St. A. *The Butterflies of East Africa and Uganda.* (Dr. van Someren.)

Yushiro Miwa. *Fauna of Elateridae in the Japanese Empire.* (Dept. of Agriculture, Govt. Research Institute, Formosa.)

Gifts of separates have been received from the following donors, and in addition 46 have been purchased. Many of those given and most of those purchased are from publications not available in Oxford.

American Museum of Natural History, 29; Arnold, G., 3; Bagnall, R. S., 18; Benson, R. B., 3; Buxton, P. A., 1; Clark, J., 3; Diver, C., 3; Dominion Entomologist, Canada, 20; Fisher, R. A., 2; Hungerford, H. B., 4; Jackson, R., 4; Lal, K. B., 2; Monro, J. W., 7; Omer-Cooper, J., 26; Peacock, A. D., 3; Richards, O. W., 1; Richards, Mrs. O. W., 3; Riley, N. D., 3; Rothamsted Experimental Station, 9; Sjöstedt, Y., 3; Talbot, G., 8.

Important Additions to the Collections

The British Collections

Chitty, A. J., the late—Examination of an unsorted series revealed many rarities and 260 beetles were incorporated, including *Anisoxya fuscula* Ill. new to the collection. Also a specimen of the fly *Germaria ruficeps* Fall., which is the only known British example with complete data.

Collins, J.—A very fine series of Diptera comprising 854 specimens of Muscidae, of which 230 belong to 54 species new to the collection, and 1,200 Tachinidae with 315 specimens belonging to 46 species new to the collection, of which *Angioneurilla cyrtoneurina* Böttsch and *Sarcophaga villeneuvei* Zett (3 males) were new to Britain when discovered by the donor.

Dixey, F. A., the late, executors of—72 Lepidoptera, comprising many local species.

Donisthorpe, H. St. J. K.—The additions to the great collection of beetles from Windsor Forest made by this good friend of the department number 224, of which 37 species have not previously been given from that locality, including *Hypophloeus fraxini* Kugel and co-types of *Cryptophagus stramenti* Donis. The number of species of beetles from this one locality given to the department stood at 1,567 at the end of June. Gifts from other localities include the rare Hemiptera *Empicoris culiciformis* De Geer and *Chlorita viridula* Fall. from Wicken Fen; a collection of 12 Staphylinid beetles from a heron's nest in Richmond Park; and 39 rare or local beetles from Killarney, including *Pterostichus aterrimus* Pk., *Stilicus similis* Er., *Euplectus pusillus* Denny, *Otiorrhynchus porcatus* Hb., and *Silpha subrotundata* var. *castaneicolor* Donis., the last three new to the collection. Other rarities include *Ptinus latro* F. from Oswestry, *Acilius canaliculatus* Nic. from Whixall Moss, Salop, and *Cryptophagus validus* Kr.

Hignett, J.—A series of the weevil *Polydrosus pilosus* Gredler from Oswestry and the bark beetle *Dryocoetes autographus* Ratz, both new to the collection.

Hobby, B. M.—A series of 42 *Lysandra coridon* Poda from Winchester showing variations of the under side, and variations of other butterflies; 88 insects, mainly Diptera, including 2 *Scatophaga stercoraria* Linn., with Dipterous prey, and the interesting Clerid beetle *Corynetes coaeruleus* De G. from the roof of Queen's College chapel where it probably preys upon the 'Death-watch beetle'. (See under publications.)

Adkin, R., Hobby, G. A., Murray, J., Poulton, Sir E. B., Walker, J. J. have also kindly given specimens.

Palaearctic Region, excluding Britain

Mavromoustakis, G. A.—56 specimens of various orders, from Cyprus.

Ethiopian region

Hodson, Sir A. W.—39 butterflies from Sierra Leone, including *Euphaedra perseis* Drury and a series of the moth *Eusemia* sp. which it resembles.

Jackson, T. H. E.—(1) A splendid collection of 644 butterflies from a most interesting locality, the Budongo forest in western Uganda. It contained 3 new Lycaenidae and a new form of *Acraea althoffi* which have since been described, 5 species of Lycaenidae and *Planema schubotzi* Grunb. new to the collection, and many other rare and interesting forms, (2) 112 butterflies from near Kampala, (3) 14 *Cymothoë johnstoni* Btlr. from Kakamega, (4) a number of species of Lycaenidae, bred from larvae, and 272 moths from Kitale.

Kenway, H. C.—20 *Charaxes* from Portuguese East Africa including *C. xiphares kenwayi* Poult. These were given in 1929. (*Trans.* 77, 482.)

Lamborn, W. A.—(1) 81 butterflies from Madagascar and 27 from the Comorò islands, (2) the mimetic association of 83 butterflies from Mt. Mlanje mentioned under publications, (3) interesting flies from Nyasaland including 9 Asilidae with pupal skins and several species of Tabanidae bred from cylinders of mud cut out by the larvae. These species are additional to those first recorded by Lamborn in 1930 (*Hope Reports*, 17, no. 25). 3 Conopid flies with puparia.

confused by an enemy with some other insect known by experience to be unpleasant, and in being unmolested so that it was free to reproduce its like.

Batesian Mimicry involves deceit, and is analogous to the fraudulent use of the trade-mark of a successful firm by a less successful competitor. Here, as in all other forms of protective resemblance, attitude and instincts play as important a part as coloration and shape, as when a spider holds up the front pair of legs and waves them in the air so that this extra pair of legs look like the active antennae of an ant.

True Mimicry is termed Pseud-aposematic coloration because, though a mimic may be conspicuous, it has nothing with which to back up its bluff. Therefore all that is necessary is that at a little distance appearances should be deceptive: profound anatomical alterations are not required by, nor are they characteristic of, Mimicry. Consequently it is often found that the same effect is produced by quite different means, one of the fundamental characteristics of the workings of natural selection.

Mimicry, depending upon deceit, cannot be too common, for it would then defeat itself, and true Batesian mimics will probably be found, when all is known, to be comparatively scarce species.

Resemblance of one insect to another is, after all, merely a case of resemblance to a particular part of the surroundings; in other words, Special Procryptic and Pseud-aposematic coloration are only different manifestations of the same phenomenon, both explicable by the operation of natural selection. Yet it is often sought to explain the latter by the operation of environment, by parallel mutation, by affinity, etc., arguments which entirely fail if applied to a stick-like caterpillar! The close analogy between the two is shown by the following two cases. The one, a spider which resembles an ant so closely that it will deceive naturalists in the field over and over again. The other, a small spider which frequents the rubbish at the mouth of an ant's nest, among which are the head-capsules of defunct ants cast out by the sanitary gang. When alarmed, this spider conceals the legs and front part of the body beneath the abdomen, which is shaped sculptured and coloured so as to resemble closely the dead ant's head. A spider resembling a living ant is Pseudaposematic, but if it resembles part of a dead ant it is an example of Special Procrypsis; in both cases the protective resemblance is to some particular part of the surroundings.

The phenomena of mimicry have been most intensively studied in butterflies, and it is necessary to consider the question—What are the enemies which act as agents of natural selection by taking one butterfly for food and ignoring another?

Owen, I. G.—A fine set of butterflies from southern Sudan, continuing the previous gifts of this series, which greatly adds to knowledge of an interesting locality. 130 specimens from various localities in Mongalla province and 127 from the Congo-Nile divide in Bahr-el-Ghazal province, a locality from which the butterflies are almost unknown. Captain Owen's collections show that the typical West African forest fauna extends eastwards to the Sudan border. Among other rarities are *Papilio plagiatus* Aur., not represented in the National Collection and new to the department.

Rogers, K. St. A.—(1) 87 butterflies and 31 moths from Kenya colony, including the rare *Apaturopsis*, a series of the rare *Acraea unimaculata* Sm. and the first *Alaena johannae* E. Sh. which the donor had seen in the colony during very many years' experience. (2) A remarkable intersex of *Papilio dardanus*, chiefly male but showing traces of the female form *cenea* Stoll, bred from an egg laid by a form *hippocoön* parent, and two small bred families comprising 17 specimens from *cenea* parents.

Rothschild, Lord.—7 Acraeines from Fernando Po and the Cameroons.

Trustees of the British Museum.—4 forms of Abyssinian butterflies not represented in the collection, in exchange.

Ungemach, H.—13 butterflies from Abyssinia comprising 8 forms or species new to the collection, of which 5 are paratypes described by him.

Van Someren, V. G. L.—6 specimens of *Euphaedra paradoxa* Neave comprising the female neallotype and types of three new forms described by the Professor, from Southern Kavirondo, Kenya Colony.

Other Regions

Andrewes, H. L.—The remainder of a large collection of Indian moths, of which the first part has already been received. The total number of specimens thus given is now 3,648.

Hudson, G. V.—18 specimens of the 'Small White' (*P. rapae* Linn.) introduced into New Zealand and likely to become a pest. The New Zealand specimens seem to be developing distinct characteristics.

Lever, R. A.—130 butterflies from the Solomon Isles, continuing the great series already given, and from some islands not previously concerned.

Malaise, R.—Paratypes of 3 species of saw-flies from Burma: *Tenthredo cyanata* Kun, and *T. pseudomelaena*, and *T. katchinensis* described by the donor.

Myers, J. G.—(1930) 68 specimens of various non-lepidopterous orders from Haiti; (1931) 66 butterflies from Trinidad and the adjoining mainland.

Simmonds, H. W.—29 butterflies from Fiji and 3 families of *Hypolimnas bolina* Linn. bred from known female parents, containing no males, and the following numbers of female offspring 20, 37, 41 (see under publications); also a family containing 2 males and 36 females.

Walker, J. J.—201 butterflies, mainly Lycaenidae, from various parts of the coast of S. America.

Specimens have also been received from Benesh, B., Owen, C. M., and Schiller, F. C. S.

Accessions of Special Bionomic Interest

Brown, E. S.—3 Ortalid flies, *Chrysomyza demandata* F., bred from manure and 3 Hymenopterous parasites bred from this species, rare in England.

Burtt, E.—41 wings of species of *Charaxes* picked up under a flowering tree in Tanganyika Territory: the butterflies had been destroyed by some enemy. The wings were much scratched but showed no beak marks.

Chorley, T. W.—Honey bees from Uganda with mimetic flies *Eristalis plumipes* Bezzi, the Tachinid parasite *Rondanioestrus apivorus* Vill. and the parasitic Conopid *Physcocephala microvena* Brun. with puparia in situ in the bees' abdomens. (See under publications.)

Davis, D. H. S.—Insects found in nests of hedgehogs at Witney: Coleoptera 186, Hemiptera 34, Hymenoptera parasitica 10, Diptera 8.

Glauert, L.—The Mydaid fly *Miltinus musgravei* Mackerras

mimicking a pair in copula of the Thynnid *Elidothynnus mebbeus* Westw. in West Australia. (See under publications.)

Hayward, K. J.—8 butterflies and 1 dragon-fly from the Argentine with symmetrical injuries to the wings inflicted by an enemy.

Hobby, B. M.—A series of wings of moths dropped by bats in a porch.

Kingdon, Sir D.—(1932) 4 males and 8 females of the 'Painted Lady' butterfly (*Vanessa cardui* Linn.) captured in the Atlantic 87 miles from the nearest land. ((1933) *Proc.* 7, 567.)

Myers, J. G.—(1) The Asilid fly *Mallophora fascipennis* Macq. mimicking the bee *Euglossa fasciata* Lep. with which it was captured (1931); (2) the Reduviid bug *Hiranetis cingulatus* Stål mimicking a Braconid (1932–4). (See under publications.)

Park, J.—310 wings of moths collected under two lamps in the Hautes Pyrénées, presumably the work of bats.

Vinall, Miss.—Two sets of *Charaxes* containing 6 and 7 species caught when feeding together; a *Mantis* preying on a Sphingid moth and a migrating Hesperiid (see under publications), and specimens of Saturnid moths, of which the larvae are eaten by natives, all from Bongandanga, Eastern Congo.

Specimens of bionomic interest were also given by Chamberlain, R. E., Eltringham, H., Poulton, Sir E. B., and Simes, J. A.

Predators with Prey

These are English unless otherwise stated.

Coe, R. L.—The fly *Scatophaga lutaria* F. with Muscid prey.

Curtis, W. P., from France.—4 Asilid flies, and the Neuropterous *Ascalaphus longicornis* L. with the ant *Formica fusca* L.

Cuthbertson, A., from Rhodesia.—The following paratypes of Asilidae: *Neolophonotus* (*Lophopeltis*) *marshalli* Hobby, *Alcimus cuthbertsoni* Hobby, and a pair of *Alcimus setifemoratus* Hobby in copula.

Duarte, J.—A Crabronid with Muscid prey; 5 *Vespa* and 1 *Scatophaga.*

Goffe, E. R.—20 *Empis livida* Linn., the prey in 17 cases being *Tortrix viridana* Linn.; 15 *Empis borealis* Linn. and 3 dragonflies (*Pyrrhosoma nymphula* Sulz) from Inverness-shire.

Harwood, P.—The Asilid *Laphria flava* Linn. with Elaterid and Tachinid prey, *Empis tessellata* F. with Muscid and Bibionid prey, all from Inverness-shire.

Hobby, B. M.—2 dung-flies *Scatophaga stercoraria* Linn. with Dipterous prey; *Empis tessellata* F. with Bibionid prey.

Lamborn, W. A., from Nyasaland.—A *Hyperechia* with Aculeate prey; 24 other Asilidae.

Mavromoustakis, G. A., from Cyprus.—7 Asilidae.

Parmenter, L.—The following flies: 2 Asilidae, 2 Cordyluridae, 2 Coenosiinae, and 4 Empididae.

Richards, O. W.—1 dragon fly, 2 saw-flies, 1 Hemipteron, 3 Asilidae, 1 fly *Caenosia tigrina* F., 1 *Scatophaga ordinata* Beck.

Sperring, A. H.—1 Saw-fly with a Telephorid beetle.

Spooner, G. M.—3 Asilidae; various prey of Hymenoptera and 1 of a Cicindelid beetle. Records of the latter are hard to obtain.

Varley, G. C.—4 *Vespa*, 4 *Scatophaga*, 8 Empididae.

Smaller gifts have been received from Boyd, D. O., Freeman, R. B., Hamm, A. H., Kerrich, G. J., Pease, I. E., Poulton, Sir E. B., Simes, J. A., and Tams, W. H. T.

The year under review has not been marked by any outstanding feature, and progress has been made with sorting and labelling specimens which have long awaited opportunity.

The valuable collection of Palaearctic Orthoptera, containing many types, purchased from Dr. Malcolm Burr in 1922, has been received from the British Museum where it was required for study. The specimens have been named and arranged by Mr. Uvarov, the expert on Orthoptera.

Mr. A. S. Hicks kindly presented 4 small cabinets and some boxes containing a collection made by his son, the late Mr. J. B. Hicks. Some of the specimens from localities poorly represented in the department were welcome accessions.

The remainder of the N. Sidgwick collection of British moths has been incorporated, bringing the total up to 3,756.

A splendid gift of British Diptera from Mr. J. Collins, described in more detail above, requires special mention: the specimens were incorporated into the collection by the donor.

A fine second-hand cabinet of 100 drawers, a pair to that mentioned in last year's report, has been purchased.

Visitors

The department has been visited by naturalists and others interested in its work; there are 57 names in the visitor's book.

In addition, 70 naturalists attended the first congress of the Society for British Entomology held in the department 12–15 July under the presidency of the Professor, and in the following week 31 persons accepted the invitation of Sir Edward Poulton and Dr. H. Eltringham to the meeting of the Entomological Club. The University Entomological Society continued its regular sessions twice every term, the Professor taking the chair, and representatives of the sister society at Cambridge came over for a field meeting in Trinity Term. The Professor was one of the two delegates representing the University at the celebration of the Tercentenary of the Natural History Museum in Paris.

An exhibit illustrating the attacks of birds on butterflies was shown at the annual soirée of the Linnean Society, and specimens illustrating an important set of observations by Mr. T. H. E. Jackson were demonstrated at the first of the new exhibition meetings of the Linnean Society.

The numerous type specimens in the department continue to be used by systematists and, when possible without damage, are sent away for study. During the year 26 types have been thus utilized without damage.

Dr. R. Hanitsch has continued his studies on Blattidae (Cockroaches) and it is gratifying to record that his reputation in this work was recognized by the University, which conferred upon him the degree of M.A., *honoris causa*, on 12 March 1935.

New work by him will be found under 'publications': in these, 7 new species were described. Some of the material studied, including types and paratypes, was presented by the kindness of the owners.

The department is greatly indebted to Dr. Hobby who, while holding his fellowship, has given freely of his time and know-

ledge to help the work of the department: his bibliographical knowledge has been especially useful to the library which has been of great service to research students.

It is a pleasure to be able to thank the veteran entomologist Commander J. J. Walker, R.N., M.A., for yet another year's help with the British collections and advice on many general subjects.

The Rev. Professor L. W. Grensted has kindly helped with certain groups of British insects not usually studied, and has much enriched the collections.

To Sir Edward Poulton, F.R.S., Emeritus Professor, I would acknowledge gratefully the benefit which the department continues to receive from his practical help, kind advice, and enthusiastic support for all matters concerning the welfare of the department, while his activities and influence lead to a constant stream of accessions and a widening sphere of interest in the work.

Early in the academic year the department lost a kind friend and well-wisher by the death of Professor Mark Baldwin, Hon. D.Sc., on 8 November. He was so interested in the evolutionary aspect of the work of the department that in 1920 he endowed a fund to be known as the Edward Bagnall Poulton fund for the study of social and organic evolution. He was unable to carry out his project as generously as he wished, and before his death had expressed the wish that the funds should be allowed to accumulate until a regular income of £100 a year could be obtained. No grants, in consequence, are being made at present.

The department suffered a very great loss in January by the death of Dr. F. A. Dixey, F.R.S., who had been a Curator since 1901 and up to the time of the deplorable accident was concerned particularly with the care of the Pieridae. The gap left is likely to be a permanent one, for there seems no likelihood of obtaining the services of a successor with the expert knowledge of the group possessed by Dr. Dixey.

G. D. HALE CARPENTER.

16. Report of the Hope Professor of Zoology (Entomology) for the year ending 31 July 1936

Staff

Professor: G. D. Hale Carpenter, D.M., Fellow of Jesus College.

Assistant to the Professor, and Librarian: B. M. Hobby, M.A., D.Phil., Fellow of Queen's College.

Assistant (part time): R. Hanitsch, Hon. M.A.

Lectures and Laboratory Instruction

Ten lectures followed by laboratory instruction were given by the Professor to the students taking Zoology, in Trinity Term.

Research and Publications

Dr. Hobby has carried on his work on the Bornean insects collected by the University expedition.

Mr. E. P. Mumford (Jesus), Leverhulme Research Fellow, devoted himself from the beginning of August to an intensive study of the land and fresh-water fauna of the Marquesas Islands, and was registered as an advanced student in October.

Mr. J. Ford, B.A. (New College) has been investigating the ecology of the fauna of grassland near Headington Wick, and continued his research on the dynamics of a population of the flour beetle (*Tribolium confusum*).

Miss M. Carleton (St. Hugh's) investigated the biology of the Bean-gall sawfly of willows.

Mr. F. L. Cawley, B.A. (New College) initiated a research on the effect of ultra-violet light upon species of clothes-moth and other household pests.

Accommodation has been given to Mr. J. R. Carpenter (Lincoln College) while studying ecology as an advanced student, and to Mr. D. E. Parker and Mr. J. W. Walter of the United States department of Forest Pathology while investigating the Dutch elm disease.

The following publications during the year arise from, or concern, the work of the Department: an asterisk* indicates that some or all of the specimens concerned are in the Department.

Abbreviations for oft-recurring titles are as follows—

Proc. or *Trans.* *The Proceedings* or *Transactions of the Royal Entomological Society of London.*

E.M.M. *The Entomologist's Monthly Magazine.*

Brit. J., or *Brit. Tr.* *The Journal* or *Transactions of the Society for British Entomology.*

The initials 'E.B.P.' or 'G.D.H.C.' in brackets after the name of an author signify that the observations, or notes, were communicated, or the subject of comment, by the Emeritus Professor or the Professor.

Of General Interest

Arnold, G. (E.B.P.). 'Emergence of the sexes from cocoons of the bee *Osmia aurulenta* Panz., nesting in snail-shells at Wallasey' (*Proc.* A, *11*, 45).

Brindley, Mrs. M. D. (E.B.P.). 'The female Pied Wagtail feeding her brood on dragonflies, on the Cam, at Cambridge, July 1935' (*Proc. 10*, 64–5).

Brown, J. M. '*Sminthurides schotti* Axels. (Collembola) in Oxfordshire' (*E.M.M. 72*, 118).

Carrick, R. 'Experiments to test the efficiency of protective adaptations in insects' (*Trans. 85*, 131–40).

De Meillon, B. (E.B.P.). 'Five female fossorial wasps (*Trypoxylon lissonotum* Cam.) from compartments in the glass tube of a fountain-pen-filler' (*Proc.* A, *10*, 51–3).*

Flower, S. S. (G.D.H.C.). 'Evidence of preferential feeding by birds in Egypt' (*Proc. 10*, 88–9).

Frohawk, F. W. (E.B.P.). 'Martins and wasps nesting together' (*Proc. 10*, 71–4).

Grensted, L. W. 'The Trichoptera of the Oxford district' (*Brit. Tr. 2*, 68–72).*

Hobby, B. M. 'A bibliography of entomological notes and papers contained in the serial publications issued by local scientific societies in the British Isles—Part III' (*Brit. Tr. 2*, 167–233).

Jackson, T. H. E. (G.D.H.C.). 'A Hesperid observed to emit fluid from the anus to moisten dung for absorption' (*Proc. 10*, 79–80).

Moreau, R. E. (G.D.H.C.). 'The aposematic larva of *Brithys pancratii* Cyr. distasteful to guinea-fowl, and odoriferous white moths refused by a Galago' (*Proc.* A, *11*, 51).

Myers, J. G. (E.B.P.). 'Aquatic "Woolly-bear" caterpillars, Pleasant Hope, near Parika, Lower Essequibo River, British Guiana' (*Proc. 10*, 65–70).* 'A spider, *Aphantochillus* sp., mimicking an ant, *Cryptocerus* (*Cephalotes*) *atratus* L., taken 24 May 1935, at Kobarima, N.W. District, British Guiana' (*Proc. 10*, 70–1).*

Poulton, E. B. 'Recorded statements, published in 1613 and 1764, that birds were trained to catch butterflies' (*Proc. 10*, 45–6). '"Mosquito bites" believed by the Somali natives to be the cause of "deadly fevers", as reported by Sir Richard Burton in 1856' (*Proc. 10*, 53). 'Evidence that the growth of the Dead-nettle, *Lamium album* L., is stimulated by the presence of the Stinging Nettle, *Urtica dioica* L.' (*Proc. Linn. Soc. Lond. Session 148*, *Pt. 2*, 83–6). '*Vermileo vermileo nigriventris* Strobl (Rhagionidae) bred from hibernating larvae collected by Mr. Hugh Main in S. Portugal' (*Proc. 10*, 53–4).* 'A second record of *Callimorpha hera* in the Isle of Wight, 28. viii. 1935; records of attacks on butterflies' (*Proc. 10*, 63–4). 'The offspring of a pair of the Hawk-moth *Hyloicus pinastri* L., taken *in coitu*, 15 June 1934, on a pine-trunk at Gallows Hill, 2–3 miles S. of Bere Regis, near Wareham, Dorset, by H. L. Andrewes' (*Proc. 10*, 85–6).*

The Professor. 'A suggested explanation of variation in cryptic Lepidoptera' (*E.M.M. 71*, 234–6). 'Birds do attack butterflies' (*Science Progress 120*, 628–34). 'A note on the behaviour of New Zealand birds towards the Cinnabar moth (*Tyria jacobaeae* L.)' (*E.M.M. 72*, 162–3). 'A living specimen of the Dynastine beetle *Strategus titanicus* F. imported in bananas' (*Proc. 10*, 57).* 'Notes on larvae and pupae of *Polygonia c-album* Linn. (Lep.)' (*Brit. J. 1*, 146).

Richards, O. W., 'On a collection of Humble-bees (*Bombus* and *Psithyrus*, Hymenoptera) from Cara Island, Argyllshire' (*E.M.M. 72*, 109–11).*

Ridley, H. N. (E.B.P.). 'The luminous secretion of the centipede *Geophilus electricus* (L.) as a defence against the attacks of beetles, &c.' (*Proc.* A, *11*, 48).

Stoneham, H. F. (G.D.H.C.). '*Catopsilia* pairing in the air; *Precis* sucking at extended abdominal brushes of *Danaus chrysippus* Linn.' (*Proc. 10*, 61).

Taylor, E. 'Report on Oniscoidea (woodlice)' (*Proc. and Report of the Ashmolean Nat. Hist. Soc. of Oxfordshire for* 1935: 16–17).

Wait, W. E. (E.B.P.). 'Capture of the large *Papilio* (*Iliades*) *polymnestor parinda* Moore, by a Paradise Flycatcher—*Tchitrea paradisi paradisi* L., in Ceylon' (*Proc.* A, *11*, 46).

Walker, J. J. 'Interim report on Coleoptera and Lepidoptera' (ibid., pp. 15–16).

Wallis, H. M. (E.B.P.). 'A pebble-like Acridid which, when threatened, assumes a scorpion-like appearance: the "stone-desert", north of the Biskra oasis' (*Proc.* A, *11*, 47).

White, C. M. N. (G.D.H.C.). 'Meadow-Pipits eating the "Magpie Moth", *Abraxas grossulariata*' (*Proc. 10*, 80–1).*

Ethiopian Region

Chorley, T. W. (G.D.H.C.). 'Observations on dragonflies attacking the tsetse fly *Glossina palpalis* R.D.' (*Proc. 10*, 78–9).*

Jordan, K. 'Two new African Syntomidae.' (*Novitates Zoologicae 39*, 292–3).* 'On two South African *Charaxes* (Lepid., Nymphalidae)' (*Novitates Zoologicae 39*, 330–3).*

Poulton, E. B. 'Inquiline Tineid larva in Termitaria, Nyasaland' (*Proc. 10*, 48–51).* 'Earlier descriptions of the Tineid larva *Passalactis tentatrix* Meyr.' (*Proc. 10*, 88).*

The Professor. 'The Rhopalocera of Abyssinia: a faunistic study' (*Trans. 83*, 313–447).* 'The Butterflies of Abyssinia' (*Proc. Linn. Soc. Lond. Session 148, Pt. 2*, 96–7).* 'A new *Bematistes-Pseudacraea* combination from Uganda' (*Proc. 10*, 57–9).* 'A New African Machaerotid (Homoptera) inhabiting

For various reasons it is held that birds must be these enemies, and it is said by critics that the evidence that birds devour butterflies to any appreciable extent is lacking. But evidence is accumulating, in particular the evidence left by the mark of the beak of the bird upon the soft scales on the butterfly's wing. The imprint is often so clear that the kind of bird can be diagnosed from the shape of the beak-mark. A unique collection of these "beak-marks" is being formed at the University Museum at Oxford, and the Hope Professor would be very glad to receive additions to it. When adequate numbers of specimens have been collected from the tropics it is expected that interesting statistical data may be available bearing on the frequency of destruction of "edible" and "distasteful" butterflies by birds.

a calcareous tube' (*Proc.* *10*, 81–2).* '*Pseudacraea eurytus* (L.) and its models in the Budongo forest, Bunyoro, Western Uganda (Lepidoptera)' (*Proc.* A, *11*, 22–8).* '*Eccoptoptera cupricollis* Chd., and another Coleopterous Mutilloid' (*Proc.* A, *11*, 49–50).*

Talbot, G. 'New African Lycaenidae (Lep. Rhop.)' (*E.M.M.* *71*, 202–9).*

Other Regions

Breuning, S. 'Results of the Oxford University Expedition to Borneo, 1932. A new species of *Dihammus* Thoms. (Coleoptera, Cerambycidae)' (*E.M.M.* *72*, 109).

Hincks, W. D. 'Results of the Oxford University Expedition to Borneo, 1932. Passalidae (Coleoptera)' (*E.M.M.* *72*, 155–9).

Mickel, C. E. 'The Mutillid wasps of the Islands of the Pacific Ocean (Hymenoptera; Mutillidae)' (*Trans.* *83*, 177–312).*

Mumford, E. P. 'Terrestrial and fresh-water fauna of the Marquesas Islands' (*Ecology* *17*, 143–57).

THE LIBRARY

The following report has been prepared by Dr. Hobby. It will be seen that it has been possible to make up some arrears of binding by selling duplicate series. The library is being consulted more frequently, not only by research students, but by members of other Departments. Every effort is made to increase its usefulness while avoiding duplication of works not in frequent use which are available elsewhere in Oxford.

Several runs of periodicals not primarily concerned with entomology have been presented to the Radcliffe Science Library. Others, already available in the Radcliffe or Bodleian Libraries, have been sold and the proceeds devoted to arrears of binding. 462 volumes (to be bound as 243) were prepared for the binders, 311 (bound as 174) have been returned during the year. Lacunae were filled by the courtesy of the American Entomological Society, the Boston Natural History Society, the Colombo Museum, The Federated Malay States Museums, Harvard University, the Sociedad Entomológica Argentina, the

Schweizerische Entomologische Gesellschaft, the Société Entomologique de Belgique, and Sydney University.

The exchange of Hope Reports for the serial publications of the Hawaiian Entomological Society, the Musée du Congo Belge and the Société Entomologique de l'U.R.S.S. has been arranged.

The following are the more important books added to the library, the donor, or the fact of purchase, being stated in brackets.

Balduf, W. V. (1935). *The bionomics of entomophagous Coleoptera.* St. Louis. [Purch.]

Bischoff, H. (1927). *Biologie der Hymenopteren.* Berlin. [B. M. Hobby.]

Brues, C. T., and Melander, A. L. (1932). *Classification of insects.* Cambridge, Mass. [Harvard Univ.]

Brunner von Wattenwyl. (1897). *Observations on the coloration of insects.* Leipsig. [Purch.]

Donovan, C. (1936). *A catalogue of the Macrolepidoptera of Ireland.* Cheltenham. [Author.]

Duchesne-Fournet, J. (1908–9). *Mission en Éthiopie (1901–1903).* Paris. [Purch.]

Evans, W. H. (1932). *The identification of Indian butterflies.* Madras. 2nd ed. revised. [Purch.]

Hering, M. (1926). *Biologie der Schmetterlinge.* Berlin. [Purch.]

Jacobi, A. (1913). *Mimikry und verwandte Erscheinungen.* Braunschweig. [Purch.]

Killington, F. J. (1936). *A monograph of the British Neuroptera.* Vol. 1. London. [Author.]

Murray, D. P. (1935). *South African butterflies.* London. [Purch.]

Peterson, A. (1934). *A manual of entomological equipment and methods.* Part I. Ann Arbor, Mich. [Purch.]

Pierce, F. N., and Metcalfe, J. W. (1935). *The genitalia of the Tineid families of the Lepidoptera of the British Islands.* Oundle. [Purch.]

Portevin, G. (1929–34). *Histoire naturelle des Coléoptères de France*. Paris. 4 vols. [Purch.]

Rabaud, E. (1922). *L'Adaptation et l'évolution*. Paris. [Purch.]

Robson, G. C., and Richards, O. W. (1936). *The variation of animals in nature*. London. [Purch.]

Savory, T. H. (1935). *The Arachnida*. London. [Review Copy.]

Schröder, C. (1926). *Insektenbiologie*. Leipzig. [Purch.]

Snodgrass, R. E. (1925). *Anatomy and physiology of the honey bee*. New York. [Purch.]

Walcott, M. V. (1935). *Illustrations of North American pitcherplants*. Washington. (With notes on insects by F. Morton Jones.) [F. M. Jones.]

Warren, B. C. S. (1936). Monograph of the genus *Erebia*. London. [Review Copy.]

Large numbers of separata have been given, of which some are enumerated below, but considerations of space prevent the mention of single gifts:

American Museum of Natural History, 23; G. Arnold, 3; E. Berio, 5; J. R. Carpenter, 3; T. D. A. Cockerell, 2; J. Omer Cooper, 3; H. B. Cott, 3; C. W. Crawley, 117; T. Dannreuther, 9; H. Donisthorpe, 5; C. Elton, 3; R. A. Fisher, 3; E. S. Goodrich, 3; K. Grant, 2; E. E. Green, 2; Harvard University, 50; A. T. Hesse, 6; Johns Hopkins University, 2; W. Junk, 2; Kansas University, 6; Leeds University, 2; B. de Meillon, 3; Melbourne University, 7; M. Miles, 5; E. P. Mumford, 3; J. G. Myers, 7; D. Peláez, 3; E. B. Poulton, 48; Princeton University, 5; The Professor, 13; H. Rebel, 2; W. Roepke, 2; Rothamsted Experimental Station, 8; E. R. Speyer, 2; Taihoku Imperial University, Formosa, 9; G. Talbot, 4; W. H. Thorpe, 2; Toronto University, 4; United States National Museum, 2; D. L. Uyttenboogaart, 2; G. van Son, 2; Witwatersrand University, 5.

Mr. Crawley's donation has been placed with his previous gifts concerning the study of ants; the remaining separata,

together with many earlier accessions, have been filed in boxes which originally contained the Hope Collection of Engraved Portraits, but have been unused since the transfer of the Collection to the Ashmolean Museum many years ago. Some of the boxes were utilized in their original form; others were converted into suitable containers at a cost much below that of an equivalent number of modern files of a more convenient type.

During the year 678 works and separata have been catalogued according to authors and subjects. All uncatalogued books acquired since the last revision of the card-index in 1920 have been arranged according to subject, and, although still uncatalogued, may readily be consulted by readers.

IMPORTANT ADDITIONS TO THE COLLECTIONS

It is long since a numerical statement has been prepared to show the total additions to the collections during one year.

The following is therefore given: the total number must be very close to 15,000, for certain spirit specimens in tubes have not been enumerated.

Lepidoptera	6,520
Coleoptera	5,818
Diptera	697
Hymenoptera	106
Orthoptera	81
Odonata	70
Hemiptera	33
Miscellaneous	1,241
Predators and prey . . .	330
	14,896

Not one specimen has been purchased: the department has enough to do to keep pace with the stream of gifts from generous friends, who, it may be pointed out, are mostly *not* members of the University. Worthy of special mention is a splendid cabinet of 40 drawers with glass tops and bottoms, containing the collection of 2,947 butterflies from Great Britain and other parts of Europe made and bequeathed to the University by the late Rev. E. B. Ashby.

The British Collections

Aubrook, E. W.—20 valuable specimens including the lacewing *Eumicromus angulatus*, the parasitic Cynipid *Onychia westwoodi*, and the beetle *Bembidion redtenbacheri*, all new to the collection.

Britten, H.—6 *Opomyza lineatopunctata*, new to the Diptera collection.

Burrows, W. F.—4 *Brachytron pratense*, a welcome accession to the dragonfly collection.

Champion, H. G.—Mr. Harry Champion generously presented a very valuable series of 5,200 beetles from the collection made by his father, the late G. E. Champion. These belong to 964 species, of which 23 are new to the collection, and the rest valuable acquisitions on account of their excellent condition or because the species was previously inadequately represented.

Collin, J. E.—63 Muscid flies new to the collection.

Donisthorpe, H. St. J. K.—The comprehensive collection of beetles from Windsor Forest has been further enriched by 30 species not previously sent by the donor from this locality. These, with specimens from other localities, make up a total of 434 specimens from this donor among which *Anthicus tobias*, recently added to the British list, is noteworthy. Among notable accessions from the Forest are *Opilo mollis*, *Epuraea longula*, *Dorytomus agnathus*, *Leptinus testaceus*, *Xylophilus populnea*, *Abdera biflexuosa*, *Smicronyx jungermannica*.

Dowdeswell, W. H., and Swynnerton, G. H.—368 specimens from the island of Cara in Argyllshire. Insular collections of this type are particularly welcomed in this Department where geographical variations have always been studied with interest: other insular specimens are mentioned later.

Freeman, R. B.—25 *Bombus* from Barra Isle, Inverness-shire.

Greer, J.—26 Irish butterflies including local forms of *Coenonympha typhon* and *Polyommatus icarus*.

Grensted, L. W.—A number of Caddis-flies (Trichoptera): two Stone-flies (Perlidae), *Amphinemura standfussi*, new to the collection.

Harwood, P.—2 specimens of the Hemipteron *Salda setulosa*, new to the collection.

Hobby, B. M.—41 specimens from various localities, mainly Diptera.

Jannings, Miss C. M.—13 *Bombus* and 3 Bombyliid flies from the Isle of Eigg.

Jones, E. W.—20 *Cis bilamellatus*: a new record for this beetle in Oxfordshire.

Pool, C. J. C. (the late)—292 beetles were incorporated from a collection which had long been in the department. Noteworthy species are *Pelophila borealis*, *Dytiscus dimidiatus*, *Oxytelus fulvipes*, *Homalium rugulipenne*, *Anommatus* 12-*striatus*, *Aphodius niger*, *Lymoxylon navale*, *Bostrychus capucinus*, *Eriocephalus polonicus*.

Swynnerton, G. H.—4 females, including the type, of a new variety (*swynnertoni*) of the Humble-bee *Psithyrus campestris* from Cara island. See also under Dowdeswell.

Taylor, E.—150 specimens, including the Trichoptera *Triaenodes bicolor* and *Holocentropus picicornis* new to Oxfordshire.

Terry, F. W. (the late).—350 insects of various orders, from various localities within and without Great Britain, were incorporated from an unsorted collection which had long been in the department.

Walker, J. J.—A number of beetles including two *Philonthus rectangulus* only recently recorded for Britain and new to the collection, and six *Anthicus bifasciatus*.

White, C. M. N.—7 specimens from N. Uist, and 33 from Northern Knapdale, Argyllshire.

The following also contributed specimens to the British Collections:—Burrows, W. F.; Carpenter, G. D. H.; Ellis, H. W.; Kerrich, G. J.; Sandemann, R. G.; Sollas, Miss I.

Palaearctic and Nearctic regions, excluding Britain

Dammers, C. M.—8 magnificent bred specimens of the little-known Hesperiid butterflies *Megathymus yuccae navajo* and *M. stephensi*.

Lupton, Miss P. M., and Wykes, Miss U. M.—329 insects of various orders from S.W. Iceland, including a species of *Aphis* new to science but not yet described, and the following not recorded previously from Iceland. Coleoptera, *Oxytelus perrisi*; Diptera, *Spaniotoma* species near *effusus*, *S.* species near *brevicalcar*, *S.* species near *minimus*, *Tanytarsus sylvaticus*; Trichoptera, *Limnophilus sparsus*.

Mavromoustakis, G. A.—226 non-Lepidopterous insects from Cyprus by exchange.

Oxford University Exploration Club.—23 insects from the 1933 expedition to West Spitzbergen and 110 from the Ellesmere Land expedition 1935. A valuable addition to the Arctic collections from previous expeditions, providing fine material for a study of Arctic insects.

United States Division of Forest Pathology, per Parker, D. E. —16 specimens of forest pests from New Jersey.

Specimens were also received from Poulton, E. B. (Madeira); and Kendrew, W. G. (Amazons).

Ethiopian Region

Jackson, T. H. E.—The specimens, mainly butterflies, presented by this keen supporter of the Department, numbered 2,285: this figure does not include very many duplicates put aside in papers in case further specimens are needed. The collections were made (A) in Kenya Colony on Mt. Elgon, and at Kakamega; the latter locality being likely to provide interesting races; (B) at Katera, a forest locality on the north-west coast of Uganda which has already provided new forms and is particularly interesting in comparison with Entebbe on the north shore of the lake where Dr. C. A. Wiggins made the fine collection which he gave to the Department; (C) L. Nabugabo, a small area on the north-west coast of Lake Victoria. This collection seems to repeat the phenomena of variation shown by the mimetic forms of *Pseudacraea eurytus* on the Sese Isles in the absence of their models; further specimens from this locality are awaited with interest; (D) the Budongo and Kalinzu forests in western Uganda, relics of the former eastward extension of the great Congo forest, providing many western forms.

Especially worthy of mention in Mr. Jackson's gifts are the types of *Acraea kalinzu* described by the Professor (*vide* publications) and of a subspecies of the little-known *Charaxes eudoxus* shortly to be described in a revision of the species. Many other interesting specimens still await proper examination.

Moysey, F.—447 butterflies from the neighbourhood of the Sudan-Uganda-Kenya frontier—a locality now well represented in the Department, thanks to the generosity of this, and the next, donor. It is hoped that it will be the subject of a comprehensive study in the future.

Owen, I. G.—32 butterflies from south and south-west Sudan, from which Captain Owen has already sent much interesting material. They include the western species *Euphaedra xypete* and *Oxylides homeyeri.*

Obenberger, J.—A male *Papilio dardanus* from Lake Tsana in Abyssinia: one of the seven mentioned by Kheil as taken with the new female forms *ruspinae* and *niavioides*. The Department is much indebted to Professor Obenberger for kindly sending so important a specimen.

Wood, R. C.—5 specimens of the Lycaenid *Durbania limbata* hitherto not well represented.

The following also contributed specimens from Africa:— Kenway, H. C.; Russell, C. B.; Simmons, W. C.; van Son, G.

Indo-Australian Region

British Museum, Trustees of.—51 dragonflies (Odonata), representatives of a collection made by the Oxford University Exploration Club in Borneo, including paratypes of *Drepanosticta dulitensis* and *D. forficula.*

Goodrich, E. S.—5 cave-dwelling grasshoppers (Phasgonuridae, *Diestrammena gravelyi*) from the Batu caves, Selangor.

Gunther, K. J.—14 Acridid grasshoppers from Borneo, by exchange, including 9 species new to the collection.

Lever, R. A.—158 butterflies from the Solomon Islands, adding to knowledge of the fauna of individual islands and including *Ornithoptera victoria reginae* new to the collection and not

previously recorded from San Cristobal Isle. Also the first female *Euploea* recorded as sharing the male habit of collecting on twigs of *Tournefortia* (vide *Hope Reports* 22, item 21 d, 5).

Accessions of Special Bionomic Interest

It is convenient to place here a number of records of Orthoptera brought to the Department, having been found among imported bananas, or under circumstances suggesting importation.

Chaplain, E.—Blattidae (Cockroaches), chiefly West Indian, found in bananas in a store: *Blatta orientalis*, *Periplaneta australasiae*, *Cutilia nitida*, *Pelmatosilpha occidentalis*, *Panchlora nivea*; also a Tettigoniid grasshopper, *Jamaicana* sp.

Cooper, E. M.—A Tettigoniid grasshopper in bananas from Jamaica.

Grace, E.—The Blattid *Nyctibora brunnea* in bananas from Jamaica in the Great Western Railway's goods yard.

Hamm, A. H.—An immature *Jamaicana* from among bananas at Hastings.

Killington, F. J.—The Blattid *Nauphoeta cinerea* found in a cupboard at Southampton, and kept alive since December 1935. The species is widely distributed through the tropics.

Ramsden, W.—A *Periplaneta australasiae* from bananas in a store.

Blair, K. G.—A male 'Meadow Brown' (*Maniola jurtina*) *in copula* with a female 'Ringlet' (*Aphantopus hyperanthus*) from Bagley Wood. Eggs laid proved infertile.

Cott, H. B.—A series of 80 insects taken on flowers of Cow Parsley in Northumberland.

Fletcher, T. B.—11 English butterflies with wings nibbled (probably) by wasps.

Hobby, B. M.—Dragonflies from Wicken Fen bearing the recently discovered minute Ceratopogonid fly *Pterobosca paludis* attached to the wings.

Higgins, L. G.—The butterfly *Lycaena eumedon* from Norway bearing the clear imprint of a bird's beak on the wings.

Peile, H. D.—A 'Purple Emperor' butterfly (*Apatura iris*) with wings clearly showing the imprint of a bird's beak.

Specimens of bionomic value were also received from—Bailey, F. M.; Burrows, W. F.; Callan, H. G.; Cowley, J.; Dibb, J. R.; Edwards, F. W.; Frohawk, F. W.; Killington, F. J.; Poulton, E. B.; Russell, C. B.; Tams, W. H.

Predators with Prey

Among a large number of gifts the following deserve special mention.

Andrews, H. W.—25 specimens.

Aubrook, E. W.—The Cantharid *Rhagonycha lignosa*: the first known record of this beetle with prey.

Audcent, H.—7 specimens, including a hornet preying on a honey bee.

Boyd, D. O.—43 specimens including a common wasp; although the predatory habits of wasps are well known there is insufficient evidence of the nature of their prey, often unidentifiable when captured.

Cott, H. B.—176 specimens of *Scatophaga* with prey forming a welcome addition to knowledge of the predatory activities of these flies.

Day, C. D.—*Cordulegaster boltonii* preying on a honey bee. Identification of prey is very seldom possible with these large dragonflies.

Hamm, A. H.—The fly *Coenosia humilis* with prey, and other specimens.

Parmenter, L.—16 specimens.

Richards, O. W.—19 specimens.

Specimens were also received from—Brown, E. A.; Chrystal, R. N.; Griffin, F.; Labouchere, F. A.; Salt, G.

Identification of this fine material has not been possible as yet: it awaits further study.

General Remarks

The year has not been marked by any outstanding feature. Mr. J. Collins, having attained the age of 70, retired from the

A SUGGESTED EXPLANATION OF VARIATION IN CRYPTIC LEPIDOPTERA.

BY G. D. HALE CARPENTER, D.M., F.R.E.S., F.L.S., F.Z.S.
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Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxi.

An explanation of a phenomenon becomes the more convincing if conceived independently by a second person unaware that the same suggestion had been made many years before.

Mr. G. V. Hudson in the July number of this Magazine, under the title at the head of this note, writes (pp. 156-8) in a most interesting article : 'So far as I am aware no attempt has so far been made to explain why Cryptic Coloration should be associated with great variability'; and in a later passage, after alluding to 'the conception of "Common Warning Colours,"' continues : 'Now the idea which has occurred to me is the obverse of this. A cryptic resemblance . . . if possessed by a common and highly edible species, would soon be recognised and learnt by predators, and . . . would tend to become less efficient as the knowledge of predators increased. On the other hand, if the disguise is varied in endless detail, the task of learning and locating the cryptic species is enormously increased, and in this way great benefit will accrue to all species which add to a cryptic appearance the additional attribute of great variability.'

Mr. Hudson's conclusions, derived from the study of the New Zealand fauna alone, are rendered more valuable by the interesting locality. It is, however, only just that it should be realised

post of senior assistant on November 1st; the loss of his wide experience of British insects has been much felt, and of his craftsmanship in setting up labels. Under Sir Edward Poulton's tuition the art of labelling specimens reached a very high standard, and the Hope Department's labels are widely recognized to attain in the highest degree the ideal of *multum in parvo*. Mr. Collins has also been a generous donor of specimens. His place was taken by Mr. E. W. Aubrook who became junior assistant, and during the past nine months has shown every promise of becoming a worthy successor.

The Emeritus Professor's activities show no signs of lessening, and his kind help and experienced advice have been greatly appreciated.

Dr. Hanitsch has continued his work upon Blattidae of New Guinea, based upon two large collections from the museums at Berlin and Buitenzorg: with Dr. Hobby he continued work upon the Blattidae collected by the expedition to Borneo. His expert knowledge was sought by museums in Amsterdam, Java, and Bonn, in the identification of Blattids from the tropics, and some of the specimens were obtained for the collections.

The veteran Commander J. J. Walker, R.N., F.L.S., continues to work regularly for the Department; the great task of selecting and incorporating specimens from the Champion collection was entirely his.

Professor Grensted, D.D., has continually helped with his knowledge of special groups, and with kind gifts of specimens.

Dr. B. M. Hobby has, as ever, been simply invaluable, and it is certain that the trouble he takes to assist students is greatly appreciated by undergraduates. His bibliographical knowledge is of much help in enabling purchases to be made for the Library, the report on which has been primarily prepared by him.

The Professor and Dr. Hobby exhibited a series of butterflies with beak-marked wings, and of predators with prey, at the autumn conversazione held by the Royal Entomological Society for the Conference of Imperial Entomologists. Selected examples from the Hodson Abyssinian collection were demonstrated by

the Professor at an exhibit meeting of the Linnean Society. The Professor contributed, by invitation, to a discussion at the Royal Society on the present position of the theory of Natural Selection, and presided over the annual congress of the South-Eastern Union of Scientific Societies held at Oxford.

The University Entomological Society (Secretary: R. B. Freeman, Magdalen College) met twice each term as usual and sent representatives to a meeting of the sister society at Cambridge. The 'Type' specimens in the collections continue to be used by specialists and when practicable without injury are loaned for study.

Many naturalists have visited the Department, including the following whose names are selected from the 56 in the visitors' book:

Beattie, R. Kent, principal pathologist, Forest Pathology, U.S. Dept. of Agriculture.

Cott, H. B., Department of Zoology, University of Glasgow.

Ferrière, Ch., Imperial Institute of Entomology.

Jackson, T. H. E. (in connexion with the great collections given by him).

Lyman, E. M., Entomological Room, Redpath Museum, McGill University.

Main, Hugh.

Moreau, R. E., Agricultural Research Station, Amani, Tanganyika Territory.

Patton, Major W. E. (to study Diptera).

Richards, O. W., Imperial College of Science.

Sopwith, A., Science master, Bradfield, with a party of boys.

Stockman, E. C., Professor of Plant Pathology, University of Minnesota.

Vinall, Miss Gertrude (in connexion with collections given by her).

G. D. HALE CARPENTER.

16. Report of the Hope Professor of Zoology (Entomology) for the year ending 31 July 1937

Staff

Professor: G. D. Hale Carpenter, D.M., Fellow of Jesus College.

Assistant to the Professor, and Librarian: B. M. Hobby, M.A., D.Phil., Fellow of Queen's College.

Assistant (part-time): R. Hanitsch, Hon. M.A.

Lectures and Laboratory Instruction

The biennial course was not given this year.

Research and Publications

Dr. Hobby has continued work on the Bornean insects collected by the University expedition, the Blattidae being studied with the aid of Dr. Hanitsch, who for the greater part of the year was engaged on his proposed monograph of the Blattids of New Guinea.

Mr. E. P. Mumford (Jesus), whose Leverhulme Research Fellowship was renewed for a second period, continued his study of the land and fresh-water fauna of the Marquesas Islands.

Mr. J. Ford, B.A. (New College), continued researches on the problems of animal populations, as exemplified by the fauna of grassland and cultures of the flour beetle (*Tribolium*).

Accommodation has been given to Mr. J. R. Carpenter (Lincoln) while studying ecology as an advanced student, and to Mr. D. E. Parker and Dr. J. M. Walter of the United States Department of Forest Pathology for their continued researches into Dutch Elm Disease.

The following publications during the year arise from, or concern, the work of the Department: an asterisk (*) indicates that some or all of the specimens concerned are in the Department. Abbreviations for oft-recurring titles are as follows—

Proc. or *Trans. The Proceedings* or *Transactions of the Royal Entomological Society of London.*

E.M.M. The Entomologist's Monthly Magazine.

Brit. J., or *Brit. Tr.* *The Journal* or *Transactions of the Society for British Entomology.*

Ecol. The Journal of Animal Ecology.

Ann. Mag. The Annals and Magazine of Natural History.

The initials 'E.B.P.' or 'G.D.H.C.' in brackets after the name of an author signify that the observations, or notes, were communicated, or the subject of comment, by the Emeritus Professor or the Professor.

Of General Interest

Aubrook, E. W. 'Spiral segmentation in the immature stages of *Hipocrita jacobaeae* L. (Lep. Arctiidae)' (*Brit. J. 1*, 186–7).*

Carpenter, J. R., and Ford, J. 'The use of sweep-net samples in an ecological survey' (*id.* 155–61).

Ford, E. B. 'The Genetics of *Papilio dardanus* Brown (Lep.)' (*Trans. 85*, 435–66).*

Ford, J. 'A method of counting large samples of small Arthropods' (*Ecol.* 5, 396–7). 'Escape of butterfly after capture by bird' (*Brit. J. 1*, 178). 'Research on populations of *Tribolium confusum* and its bearing on ecological theory: a summary' (*Ecol.* 6, 1–14). 'Fluctuations in natural populations of Collembola and Acarina' (*id.* 98–111).

Hibbert Ware, Miss A. (E.B.P.). 'Notes on the insect-food of the little owl' (*Proc.* A, *12*, 68).*

Hobby, B. M. 'Dragonflies and their prey' (*Proc.* A, *11*, 101–3).* 'A note on the hind-wings of a sawfly, leaf-hopper and moth' (*Proc.* A, *12*, 72–4).* With E. B. Poulton, 'Bees and Conopidae (Dipt.)' (*Brit. J. 1*, 180).*

Jones, F. M. (E.B.P.). 'Relative acceptability and poisonous food-plants' (*Proc.* A, *12*, 74–6).

Latter, O. H. (E.B.P.). '*Aglais urticae* L. attracted by lamp-light after hibernation' (*Proc.* A, *11*, 96–8).

Lever, R. A. (E.B.P.). 'Euploeine butterflies feeding at the broken surface of a *Tournefortia* branch, and some days later on the withered leaves of the same branch: Tulagi, Solomon Isles, 1936' (*Proc.* A, *11*, 94–6).*

Myers, J. G. (E.B.P.). 'Mimetic and other associations between neotropical insects and spiders' (*Proc.* A, *12*, 70–2).*

Parmenter, L. 'Predacious flies and their prey' (*London Naturalist*, *1936*, 51–4).*

Poulton, E. B. 'The identity of dragonflies offered to her young by a pied wagtail on the Cam' (*Proc.* A, *11*, 45). '*Aglais urticae* L. with symmetrical injuries possibly inflicted before hibernation, flying in house, 30 March, 1936, St. Helen's, Isle of Wight'* and 'Further reference to termitophilous Tineid larvae of the genus *Passalactis* Meyr.' (*Proc.* A, *11*, 98).* 'Assemblies of Coccinellid beetles observed in N. Uganda (1927) by Professor Hale Carpenter and in Bechuanaland (1935) by Dr. W. A. Lamborn' (*Proc.* A, *11*, 99–100).* 'Evidence that the Growth of the Dead-nettle, *Lamium album* L., is stimulated by the presence of the Stinging-nettle, *Urtica dioica* L.—Further observations' (*Proc. Linn. Soc. Lond.*, *1936–7*, 1–6). 'A cat capturing and eating a large Californian Papilio' (*Proc.* A, *12*, 10). 'Emergence of the parasitic Ichneumonid *Orthopelma luteator* Grav. from the gall of *Rhodites rosae* L.' (*Brit. J.* *1*, 179).* 'The procryptic appearance in two resting attitudes of the Geometrid moth *Fidonia plummistaria* Vill. (= *plumistaria* Bkh.) observed by Lt.-Col. H. D. Peile at Mentone, S. France' (*Proc.* A, *12*, 69).

The Professor. 'A note on the courtship of Termites' (*Proc.* A, *11*, 93–4). 'A flight of a butterfly that appeared to be *Catopsilia florella* Fab. in the straits of Messina' (*Proc.* A, *12*, 9). 'A note on some parasites of *Zygaena* (Lep.)' (*Brit. J.* *1*, 176–8). 'Insect Coloration' (*Nature*, *138*, 243). 'Insect Coloration and Natural Selection' (*id.* 686–7). 'The Facts of Mimicry still require Natural Selection for their Explanation' (contribution to 'A discussion on the present state of the theory of Natural Selection', *Proc. Roy. Soc. Lond.* B, *121*, 65–7). 'Charles Darwin and Entomology' (*Trans. S.E. Union Sci. Soc.* *1936*, 1–23. Presidential Address). 'Entomology and Natural Selection' (*Journ. Br. Assocn., Blackpool*, *1936*, 38). 'Mimicry, as viewed by Professor Shull' (*Science*, *85*, 356–9). 'The needs of the mimetic theory' (*Science*, *86*, 157).

Richards, O. W. 'The mating-habits of species of *Vespa* (Hymen.)' (*Proc.* A, *12*, 27–9).

Simmonds, H. W. (E.B.P.). 'Notes on *Hypolimnas bolina* L., and the food preferences of the giant toad (*Bufo marinus* L.) in Suva, Fiji' (*id.* 69–70).

Van Someren, V. G. L. (E.B.P.). 'Chemical changes in the food-plant a cause of failure in rearing larvae' (*id.* 10).

Warren, B. C. S. (G.D.H.C.). 'On the evolution of sub-species, as demonstrated by the alternation of variability existing in the subspecies of the genus *Erebia* (Lepidoptera)' (*Journ. Linn. Soc. Zool. 40*, 305–21).

Oriental Region

The following papers deal with 'Results of the Oxford University expedition to Sarawak (Borneo), 1932'.* To save space these words, or their equivalent, are omitted from the titles.

Bernhauer, M. 'Neue Staphyliniden (Coleoptera)' (*Proc.* B, *5*, 24–6).

Breuning, S. 'Three new species of Lamiinae (Coleoptera, Cerambycidae)' (*E.M.M. 73*, 57–8).

Cooman, A. de. 'Description de *Nicotikis hobbyi* sp. n. (Histeridae)' (*Proc.* B, *6*, 29–30).

Funkhouser, W. D. 'Three new Membracidae from Borneo' (*E.M.M. 73*, 100–2).

Hinton, H. E. 'Dryopidae (Coleoptera), Part 1' (*Ann. Mag.* (10), *18*, 89). 'Dryopidae (Coleoptera), Part 2' (*id.* 204).

Kimmins, D. E. 'Odonata' (*Journ. F.M.S. Mus. 18*, 65–108).

Mickel, C. E. 'New Species and Records of Mutillidae (Hymenoptera) from Borneo and the Solomon Islands' (*Ann. Mag.* (10), *19*, 441–56).

Ochs, Georg. 'Gyriniden (Coleoptera)' (*id.* 596–617).

Parker, J. B. 'Bembecinae (Hymenoptera)' (*E.M.M. 73*, 129–33).

Pic, M. 'Nouveaux Coléoptères (Malacodermata et Anobiidae)' (*Proc.* B, *6*, 52–3).

Schwarz, H. F. 'Bornean stingless bees of the genus Trigona' (*Bull. Amer. Mus. Nat. Hist.* *83*, 281–329).

The following papers are by Dr. Hanitsch. 'Fauna Buruana, Blattidae' (*Treubia* (*Buitenzorg*), *7*, 389–400).* 'On a remarkably coloured *Panesthia* (Blattidae) from Sumba Island' (*Proc.* B, *6*, 7–8). 'On some Blattids from Kashmir, and a new genus from the Transvaal' (*Opuscula Entomologica*, *1*, 102–5).

Ethiopian Region

China, W. E. (G.D.H.C.). 'A remarkable new ant-like Lygaeid from Egypt (Hemiptera Heteroptera)' (*Proc.* B, *5*, 164–7).

Hobby, B. M. 'The Ethiopian species of the *fasciata* group of the genus *Bactria* (= *Promachus*) (Diptera, Asilidae)' (*E.M.M.* *72*, 182–278).*

The Professor. 'The description of *Acraea kalinzu* sp. n. (Lepidoptera)' (*Proc.* B, *5*, 162–4).* 'The Rhopalocera of Abyssinia: corrections and comments by Monsieur H. Ungemach' (*id.* 196–200). 'Description of *Charaxes jahlusa ganalensis* subsp. nov. from Abyssinia (Lep. Rhopalocera)' (*id.* 64). '*Charaxes eudoxus* Drury (Lep.). A revision, with description of a new subspecies' (*Trans.* *86*, 85–99).*

van Son, G. (G.D.H.C.). 'Description of a new race of *Charaxes xiphares* (Cr.) from Southern Rhodesia (Lepid.)' (*Proc.* B, *5*, 201–7).*

Palaearctic and Nearctic Regions

Aubrook, E. W. 'Anthicidae (Col.) new to Berks. and Oxon.' (*Brit. J.* *1*, 178–9).*

Carleton, Miss M. 'A new Ichneumonid (*Scopimenus pygobarbus*) parasitic on *Nematus proximus* Lep. (Hym. Tenthredinidae) in Britain' (*E.M.M.* *73*, 61–5).

Cook, J. H. 'A contribution towards a study of *Calosoma inquisitor* L. (Coleopt. Carabidae)' (*Brit. Tr.* *3*, 79–114).

Hobby, B. M. 'Notes on the larva of *Phorodesma smaragdaria* F. (Lep.)' (*Brit. J.* *1*, 183–4).*

Poulton, E. B. 'The common earwig, *Forficula auricularia* L., observed on the wing in 1843 by J. C. Dale' (*Proc.* A, *12*, 11).* 'Notes on the larvae and pupation of the Geometrid moth *Phorodesma smaragdaria* F. (Lep.)' (*Brit. J. 1*, 181–2).*

Walker, J. J. 'Interim Report on Coleoptera and Lepidoptera' (*Proc. and Rep. of the Ashm. Nat. Hist. Soc. 1936*, 17–18).*

Other Regions

Richards, O. W. 'Results of the Oxford University expedition to British Guiana, 1929. Hymenoptera, Sphecidae and Bembecidae' (*Trans. 86*, 101–18).

Waterhouse, G. A. 'Note on *Hesperia lucanus* Fabricius (Lepidoptera)' (*Proc.* B, *6*, 16).*

The Library

The following report has been prepared by Dr. Hobby:

Much progress has been made with arrears of cataloguing, filling of lacunae, binding, comparison of duplicates, and segregation of non-entomological works, so that the library is daily becoming of more practical value to members of the Department and other research workers.

Several duplicate series of periodicals have been sold. Many non-entomological books and pamphlets have been transferred to other institutions where they will be of greater value to members of the University: viz. Bodleian, 409; Museum of the History of Science, 94; other departments, a few.

Seven hundred and seventy-nine volumes (as 341) were bound during the year; 311 of these (as 174) were in the binders' hands at the time of presentation of the previous Report. Lacunae were filled by courtesy of the Academy of Natural Sciences of Philadelphia, Ashmolean Natural History Society of Oxfordshire, Boston Natural History Society, Lancashire and Cheshire Entomological Society, East Africa and Uganda Natural History Society, and the Sarawak Museum. The Museum of Comparative Zoology, Cambridge, Mass., has added *Psyche* to the publications already being sent, and the Department has also been placed on the mailing list of the

United States Department of Agriculture. Professor L. W. Grensted gave the publications of the Royal Entomological Society of London from 1929 onwards, and Comm. J. J. Walker the *Naturalist* from 1911 and four early volumes of the *Entomologist* required to complete the set. The system of exchanging Hope Reports and separata for publications of other bodies has been extended to the Entomological Society of Finland, Entomologischer Verein zu Stettin, Muséum National de Prague, Societas Entomologica Helsingforsiensis, Societas Entomologica Lundensis, Société Royale Entomologique d'Égypte, Société Entomologique de Russie, Takeuchi Entomological Laboratory, and Woods Hole Marine Biological Laboratory.

The *Entomologische Zeitschrift* and *Entomologisches Beiheft aus Berlin-Dahlem* were added to the short list of periodicals obtained by subscription.

A long series of the *Entomological News* was purchased, completing the set except for the second volume.

Eight hundred and twenty-six books and separata were acquired during the year; the greatest number came from Comm. J. J. Walker, who has done so much to enrich the library and collections over a long period of years. The following are the more important books, their origin being indicated in brackets.

Berlese, A. (1909–25). *Gli Insetti.* Milano. 2 vols. [W. B. Alexander.]

Boisduval, J. B. A. (1832). *Icones historiques des Lépidoptères nouveaux ou peu connus.* Paris. [Purch.]

Comstock, J. A. (1927). *Butterflies of California.* California. [Purch.]

Distant, W. L. (1924). *Insecta Transvaaliensia.* London. [Purch.]

Eller, K. (1936). *Die Rassen von Papilio machaon L.* Leiden. [Purch.]

Essig, E. O. (1931). *A history of entomology.* New York. [Purch.]

Galtsoff, P. S., Lutz, F. E., Welch, P. S., and Needham, J. G. (1937). *Culture methods for invertebrate animals.* Ithaca. [J. J. Walker.]

Haase, E. (1896). *Researches on mimicry.* Stuttgart. [E. B. Poulton.]

Hemming, F. (1937). *Hübner. A bibliographical and systematic account of the entomological works of Jacob Hübner. . . .* London. 2 vols. [Purch.]

Herrick, G. W. (1935). *Insect enemies of shade-trees.* Ithaca. [J. J. Walker.]

Killington, F. J. (1937). *A monograph of the British Neuroptera.* London. Vol. 2. [Author.]

Needham, J. G., Traver, J. R., and Hsu, Y. C. (1935). *The biology of mayflies with a systematic account of North American species.* Ithaca. [Purch.]

Peterson, A. (1937). *A manual of entomological equipment and methods.* St. Louis. Part II. [Purch.]

Rensch, B. (1929). *Das Prinzip geographischer Rassenkreise und das Problem der Artbildung.* Berlin. [Purch.]

Ridgway, R. (1912). *Color standards and color nomenclature.* Washington. [Purch.]

Staudinger, O., and Rebel, H. (1901). *Catalog der Lepidopteren des Palaearctischen Faunengebietes.* Berlin. I. Theil. [Purch.]

Wasman, E. (1925). *Die Ameisenmimikry.* Berlin. [Purch.]

Weber, H. (1933). *Lehrbuch der Entomologie.* Jena. [Purch.]

Weeks, A. G. (1911). *Illustrations of diurnal Lepidoptera with descriptions.* Boston. Vol. 2. [Purch.]

Wheeler, W. M. (1928). *Foibles of insects and men.* New York. [J. J. Walker.]

The Trustees of the British Museum and the Secretary of State for India have kindly continued their gifts of entomological publications.

Donors of some of the separata are enumerated below, but considerations of space prevent the mention of all but the larger gifts.

H. E. Andrewes, 7; T. Barbour, 39; E. Berio, 3; E. A. Cockayne, 4; T. D. A. Cockerell, 19; Cornell University, 35;

that this is *not* the first occasion on which such an explanation has been put forward. It was E. B. Poulton, now Sir Edward Poulton, F.R.S., who in 1884 wrote: 'I think all will admit that the larvae upon a tree stand a better chance against their various enemies if they belong to two differently coloured species (both well protected) than if they are all the same. So dimorphism is an advantage when the divergence in colour is quite complete. Again, a large number of larvae of one colour attracts attention and multiplies the chances of detection, and increases the danger for all.'

Again, in 1888, Poulton wrote in regard to green and brown larvae: 'The fact that both varieties exist, demonstrates that the dimorphism is advantageous to the species—that each variety becomes of especial advantage when a certain proportion between the numbers of the two forms is reached.'

Allusion was made by Poulton to these conclusions in his classical work (1890) as follows: 'I believe that it is a benefit to the species that some of its larvae should resemble brown and others green catkins, instead of all of them resembling either brown or green. In the former case the foes have a wider range of objects for which they may mistake the larvae, and the search must occupy more time, for equivalent results, than in the case of other species which are not dimorphic.'

In 1908 Poulton again discussed polymorphism and wrote: 'Such differences extend the area over which an enemy must search in order to obtain its food.'

The question of polymorphism, whether among aposematic or procryptic species, is discussed in 'Mimicry,' 1933, in which the writer made use of Poulton's results in the following words: 'Thus it is to the advantage of an Apatetic species, in Poulton's words, "to extend the area over which an enemy must search." The principle is the same whether the objects resembled are leaves or other butterflies.'

It is unfortunate that Mr. Hudson was not aware of the literature of this subject when communicating his most interesting notes, which so beautifully confirm previous observations.

References.

POULTON, E. B. 1884. Trans. Ent. Soc. Lond., 1884, pp. 50—56. 'Notes upon, or suggested by, the colours, markings, and protective attitudes of certain lepidopterous larvae and pupae, and of a phytophagous hymenopterous larva.'

——— 1888. Trans. Ent. Soc. Lond., 1888, pp. 594—5. 'A proof of the protective value of dimorphism in larvae.' Section XI of 'Notes in 1887 upon Lepidopterous larvae, etc.'

T. Dannreuther, 6; H. H. Darby, 6; Delegates of the Oxford University Museum, 10; C. S. Elton, 20; E. B. Ford, 4; E. S. Goodrich, 65; Harvard College, 7; B. M. Hobby, 47; A. D. Imms, 10; Imperial Agricultural Research Institute, New Delhi, 7; F. Le Cerf, 7; Lunds Universitets, 13; E. B. Poulton, 20; The Professor, 60; Rothamsted Experimental Station, 11; H. Stempfer, 3; R. Takahashi, 13; J. J. Walker, 337; W. M. Wheeler, 7; H. Womersley, 8; Woods Hole Marine Biological Laboratory, 23.

In addition to the above a fine set of 13 portraits of distinguished entomologists was received from Dr. W. Horn, and the entomological diary of the late Edward Saunders from Mrs. Saunders.

The services of a typist, Miss A. Z. Turner, were secured for ten weeks to assist in the library, thus enabling 4,848 works and separata to be catalogued according to authors and subjects, this number including all acquisitions during the past year, the collection of separata on ants given by Mr. C. W. Crawley in 1935, 335 separata from the library of the late Dr. F. A. Dixey, and many other arrears.

IMPORTANT ADDITIONS TO THE COLLECTIONS

The following are the total additions to the insects for the year:

Lepidoptera	4,232
Diptera	1,296
Hymenoptera	521
Coleoptera	381
Trichoptera	63
Hemiptera	40
Miscellaneous	707
Predators and prey	439
	7,679

Among Lepidoptera are 1,263 butterflies from the Cameroons, purchased. Although only partially set the collection is now mentioned as it forms a complete entity, representing a part of

Africa with which the Department has had little contact. A great wealth of West African species thus accrues, but the material lacks the interesting groups Acraeinae and Lycaenidae.

The collection of spiders has received a welcome accession from the Rev. J. H. Harvey, who kindly presented a large collection from British localities not very well represented in the Pickard-Cambridge collection. They were sorted, labelled, and put into convenient receptacles to await attention by an arachnologist.

The British Collections

Aubrook, E. W.—A Caddis-fly (Trichoptera) new to Oxfordshire, *Orthotrichia angustella*; 9 *Stiphrosoma sabulosum*, an interesting fly with much-reduced wings, new to the collections; a series of Braconid parasites of the common Tiger-moth.

Burrows, W. F.—A pale form of the 'Meadow-Brown' (*Maniola jurtina*); *Thecla betulae* ab. *unicolor*, and other specimens.

Collins, J.—37 specimens, including a series of a Braconid parasite bred from the burrows of the wood-boring beetle *Hylesinus fraxini*; a series of the Homopterous *Deltocephalus theni* new to the collections, and *Corizus capitatus* (Heteroptera). All from the Oxford district.

Donisthorpe, H. St. J. K.—187 specimens, including 6 *Philonthus rectangulus* (Coleoptera). Also many accessions to his fine collection of beetles from Windsor Forest, of which 27 species are new to it, including *Gastrallus laevigatus*, a recent addition to the British list, and co-types of *Leptacinus intermedius* only recently described by Mr. Donisthorpe. The Windsor Forest collection now contains 1,640 species of beetles.

Dowdeswell, W. H.—79 moths and bees from Cara Isle, Argyllshire: a welcome addition to the series by the same donor reported last year. The unusual prevalence of melanism has been discussed by Mr. Dowdeswell in a recent paper.

Freeman, P.—4 Tettigoniid grasshoppers, *Metrioptera brachyptera* and *M. roeselii*.

Freeman, R. B.—A fine collection of 476 specimens from Barra Isle, Hebrides, representing most of the larger orders of insects and continuing the gift from the same locality last year. Such insular collections are of particular interest to the Department.

Grensted, L. W. and A. D.—30 Trichoptera from Somerset, and a series of the Tineid moth *Glyphypteryx fischeriella* bred from the stems of *Dactylis glomerata*: 15 other specimens from Somerset, including the rare beetle *Atheta magniceps* and the fly *Phaonia mirabilis*.

Hobby, B. M.—553 specimens, mainly Diptera, including Conopid flies not commonly taken in numbers, Dipterous and Hymenopterous parasites bred from larvae of the moth *Cucullia verbasci*, and the rare Scorpion-fly *Panorpa cognata*. From various localities in and around Oxfordshire.

Moseley, M. E.—4 *Siphlurus linneanus* (Trichoptera) new to the collections.

Perkins, R. C. L.—10 interesting bees from the Aran Isles, including *Ancistrocerus trimarginatus* var. *albotricincta*, and a co-type of *A. pictus hibernica*, both recently described forms new to the collections.

The Professor.—325 specimens from north Cornwall, including 123 Ichneumonidae and other Hymenoptera frequenting flowers of *Smyrnium*.

The following also kindly contributed specimens: Cook, J. H.; Evans, G. H.; Middleton, A. D.; Somerset, W. H. B.; Walker, J. J.

Palaearctic Region, excluding Britain

Audcent, H.—Asilid and Conopid flies from France and the Canary Islands, 11 specimens.

Collin, J. E.—34 Diptera from Spitzbergen.

Oxford University Exploration Club.—555 insects from western Greenland, 31 from North East Land.

Venables, L. S. V.—16 specimens from Swedish Lapland.

Wager, L. R.—217 specimens collected by the expedition to eastern Greenland led by Mr. Wager, who generously gave

them to the University. The fauna of east Greenland is less known than that of the west, and there are interesting differences; this series therefore is of considerable value and will add new facts of distribution.

The collection of Arctic insects is growing very satisfactorily, and provides special facilities for study of this region as the specimens are kept in a special cabinet and not dispersed by species.

White, C. M. N.—36 butterflies from Crete, including *Coenonympha thyrsis*, peculiar to the island, and *Heodes phlaeas* with tails shorter than usual in the Mediterranean area. Such insular forms are of peculiar interest to the Department.

Ethiopian Region

Berkeley, M. S.—*Papilio demodocus* ab. *cariei*; an interesting mutation which appears in widely separated localities; new to the collection.

Bromley, S. W.—Paratypes of 5 of his new species of Asilid flies, particularly appreciated on account of Dr. Hobby's researches on this group.

Curran, C. H.—Paratypes of 5 of his new species of the peculiar flies Diopsidae, from the Cameroons.

Gunther, R. W. T.—174 butterflies from the Cameroons, filling gaps in the collection, particularly among the Lipteninae.

Jackson, T. H. E.—(A) 320 butterflies from various localities around the coast of Lake Victoria, from Mt. Elgon, and from the Kalinzu forest in western Uganda which contains interesting West African forms and is comparatively unknown. (B) A large collection of butterflies from the great Budongo forest of Bunyoro, an isolated remnant of the formerly more extensive West African rain-forest. Mr. Jackson has already added to our knowledge of this locality, and the present accession is almost embarrassing in its wealth. It has been necessary to obtain aid from outside in setting the specimens, of which 1,317 have now been added to the Department's geographical series, but represent only a moiety of this fine gift.

Kenway, H. C.—Both sexes of interesting forms of *Charaxes xiphares* and *druceanus* from Natal.

Owen, I. G.—502 butterflies from localities in south and south-western parts of the Sudan, including the Abyssinian border and the Congo-Nile watershed; little-known areas offering material of much interest for study of geographical variations. Major Owen's return to England means that a generous flow of gifts comes to an end; during his service in the Sudan he has presented over 13,000 butterflies, some new to the collections, and all of value for the localities, on which several notes have been published. It is hoped that a more comprehensive paper may be possible during the coming year.

van Son, G.—10 *Charaxes xiphares*, examples of his new subspecies *bavenda* and *vumbui* from north Transvaal.

Wood, R. C.—25 butterflies from Nyasaland.

Specimens have also been received from G. L. R. Hancock, Uganda.

Other Regions

Killington, F. J.—22 Coleoptera from Australia.

Lever, R. A.—110 butterflies from the Solomon Isles, including the Georgia and Choiseul groups, not previously represented in the many gifts from Mr. Lever from 1932 to 1937. He has now left the Solomon Isles, so that no further accessions can be expected, and it is hoped to utilize the whole collection of nearly 1,100 specimens for the basis of a critical study during the coming year of the distribution of forms of *Euploea* in these islands.

Lloyd, A. H.—58 butterflies from the hills of eastern Punjab.

Thomas, R. H.—35 Coleoptera and 11 butterflies from the upper Amazons, some of the latter poorly represented in the collections. One of the Dynastid beetles may be new to science.

Finally, a generous gift from Lt.-Col. H. D. Peile, I.M.S., must be mentioned, although circumstances have not yet allowed it to be handled: a large collection of carefully selected butterflies, many rare, in splendid condition with complete data, from the Himalayas. Voluntary skilled aid for this and other additions to the collections would be greatly appreciated.

Accessions of Special Bionomic Interest

Campbell, W. D.—The Tettigoniid grasshopper *Microcentrum rhombifolium* found in a peach-house. A North American species.

Chrystal, R. N.—12 specimens of the wood-boring beetle *Polygraphus pubescens* found abundantly in spruce in Suffolk. Previously known in Britain by one or two records, it is now a localized pest.

Fletcher, T. B.—A Burnet-moth and wasp with orchid pollinia adhering.

Groome, J. R.—A Braconid, *Chrymelus rubiginosus*, trapped by its ovipositor in the cocoon of a clothes-moth.

Hamm, C.—An immature female Tettigoniid, *Jamaicana* sp., found in bananas at Hastings.

Lamborn, W. A.—Representatives of an enormous assemblage of the 'Lady-bird' *Epilachna dregei* on the trunk of a fig-tree, Bechuanaland.

Walker, J. J.—15 specimens of *Graphocephala coccinea*, the 'Rhododendron bug' recently added to the British list.

The interesting special collection of the wings of moths dropped by bats when feeding in habitual resting-places, commenced by the Emeritus Professor, has been enlarged by specimens received from him, and from Aubrook, E. W., Hobby, B. M., and Urich, F. W., in Trinidad.

Predators with Prey

This speciality of the Department has received large accessions, of which the following are the chief:

Coe, R. L.—26 Empididae and prey from Scotland.

Hobby, B. M.—About 60 Diptera with prey, including *Pachymeria tumida*, a fly new to the collections.

Kerrich, G. J.—Empididae, *in copula*, with prey; 2 Asilidae from East Tyrol with prey; and other gifts.

Moore, M. S., Mr. and Mrs.—A number of Asilidae and prey from Serengeti plain, Tanganyika Territory: a welcome first instalment from new friends of the Department.

Parmenter, L.—Asilidae, Empididae, and Cordyluridae with prey; 83 specimens, from Cornwall.

Saunt, J. W.—Asilidae, Empididae, and Cordyluridae with prey: 18 specimens.

Varley, G. C.—234 specimens of Vespidae, Empididae, and Cordyluridae with prey, from Cambridge.

Specimens were also received from—Audcent, H.; Donisthorpe, H. St. J. K.; Fletcher, T. B.; Killington, F. J.; Parsons, B. T.

Evidence that Birds prey upon Butterflies

The argument that birds do not often attack butterflies and therefore cannot play the part assigned to them as producers of Mimicry is being met by the steady accumulation of evidence. The previous method of publishing detailed descriptions of specimens bearing marks of birds' beaks as they came to hand will be discontinued. Each new specimen is being described in a card-catalogue which will be deposited, among other statistical data, at the British Museum (Natural History), and the butterflies are kept in a special cabinet devoted to this material alone.

The following new beak-marked specimens have been received from the donors named; many others have been taken from the existing general collections.

Aubrook, E. W.—*Pieris rapae* from the Museum grounds.

Cox, W. E.—The Geometrid moth *Boarmia consonaria*, and dismembered wings of *Pieris brassicae.*

Dowsett, F.—16 dismembered wings of *P. brassicae*, both sexes, found under a tree at Tring, some of them with beak-marks.

Fraser, J. F. D.—*Aphantopus hyperanthus* from Herefordshire; dismembered wing of *P. brassicae* from Oxford.

Trustees of the British Museum through the Keeper of Entomology.—*Bematistes* (= *Planema*) *quadricolor*, *Acraea amicitiae*, and *A. johnstoni* from Ruwenzori Mountains, Uganda, and *Mnasitheus simplicissimus* from Brazil.

Walker, J. J.—*Libythea philippina*, a rarity from Manila, new to the collections.

General Remarks

The year has been one of steady progress in orderly re-arrangement and sorting. The immense numbers of specimens for which there is no cabinet accommodation are now grouped in boxes, geographically. The most important piece of re-arrangement was the collation by Mr. Taylor of the great Wiggins collection, mainly from Uganda, the numerical basis of much work upon the mimetic associations of that country. Formerly dispersed in many boxes and drawers in different parts of the Department, it now occupies one of the large cabinets of 100 drawers purchased in 1934, and 57 drawers in adjoining cabinets, thus making it possible for the collection to be studied as a whole: as an object-lesson in mimicry it probably cannot be equalled. This work occupied Mr. Taylor for over three months: he also thoroughly overhauled the whole Pickard-Cambridge collection of spiders, and sorted, and classified by islands, the Lever collection from the Solomon Isles.

A cabinet of 68 drawers, and another of 20, both second-hand, were purchased, the latter by a grant from the Museum Delegates.

It was a great pleasure to receive help from Dr. W. A. Lamborn, O.B.E., in July, who extracted from the great mass of material presented by himself the many parasites he had bred from known hosts. These have been taken to the Imperial Institute of Entomology for study.

Thanks are also due to Commander J. J. Walker, R.N., Hon. M.A., for practical help and advice almost daily in the Department.

Professor Grensted, D.D., continues to help with the Trichoptera and other groups less often studied, and Dr. Hanitsch continues his studies of Malayan Blattidae.

Kind help and advice have been received from the Emeritus Professor, whose great experience is ever at the service of the Department. It is fitting to record here that he was President of the British Association for the Advancement of Science from 1 January of the present year, although the major duties of the office did not fall within the Academic Year now reviewed.

The Professor, besides lecturing to several schools and scientific societies, demonstrated in the Department to parties from Stowe and Bradfield, with their biology masters, the main facts of insect coloration and their explanation. The evident appreciation of these informal talks encourages the hope that they will be a regular feature of the work of the Department.

Dr. B. M. Hobby was President of the Society for British Entomology and delivered an address to the annual congress on Predacious insects and their prey.

The University Entomological Society met regularly under the secretaryship of Mr. R. B. Freeman.

A meeting of the Genetical Society in the Museum provided an opportunity of exhibiting, and explaining in a short paper, the great series of the mimetic butterfly *Pseudacraea eurytus* from Uganda with the families bred from known parents. The variations of this species in localities from which the models are absent are of much significance for the theory of Natural Selection. Mr. E. B. Ford utilized the great number of bred families of *Papilio dardanus*, which are one of the chief treasures of the Department, in the preparation of the important paper on the genetics of this species cited under publications.

Various 'Types' in the collections have been sent for study to specialists and have been received again without injury from transport.

Many naturalists have visited the Department, including 22 members of the Genetical Society at their meeting. The following names, excluding the Genetical Society, are selected from the 100 in the visitors' book:

Audcent, H.; Baird, A. B. (Entomological Branch, Department of Agriculture, Ottawa); Barbour, Thos. (Harvard University Museum); Baweja, K. D. (Punjab Agricultural College); Betrem, J. G. (Experimental Station, Java); Breuning, Stephen (Wien); Catala, R. (Muséum de Paris); Dammers, C. M. and Mrs. (California); Essig, E. O. (University of California); Golledge, C. J. (Imperial Institute of Entomology); Griffin, F. J. (Royal Entomological Society); Harvey, J. H.; Hull, F. M. (University of Mississippi); Liu, C. L. (Tsing Hua University,

Peiping); Loewe, J. R. and Frau (Potsdam); Lucas, E. (Winchester College); Levi, W. M. (Reading, Pennsylvania); Miles Moss, A. (Pará, Brazil); Moore, M., Mr. and Mrs. (Game Department, Tanganyika Territory); Owen, I. G., and Miss M. B.; Perkins, J. F. (Natural History Museum); Pott, R. H. (Stowe School); Schwarz, H. F. (American Museum of Natural History); Smart, J. (Natural History Museum); Thompson, W. R. (Farnham House Laboratory); Tindale, N. B. (South Australian Museum, Adelaide); Waterhouse, G. A. (New South Wales); Watkins, A. E. (Cambridge); Whitfield, F. G. S. (Kitchener School of Medicine, Khartoum); Wood, A. H. (Bradfield).

G. D. HALE CARPENTER.

POULTON, E. B. 1890. 'The Colours of Animals,' 2nd edition, 1890. Kegan Paul, Trench, Trubner & Co., p. 47.
——— 1908. 'Essays on Evolution,' Oxford, 1908, p. 310. 'Dimorphism and Polymorphism in Procryptic Defence.'

CARPENTER, G. D. HALE. 1933. 'Mimicry' (Methuen's Monographs on Biological Subjects, Carpenter and Ford), 1933, p. 86.

University Museum, Oxford
(Department of Entomology)
August, 1935

16. Report of the Hope Professor of Zoology (Entomology) for the year ending 31 July 1938

Staff

Professor: G. D. Hale Carpenter, D.M., Fellow of Jesus College.

Assistant to the Professor, and Librarian: B. M. Hobby, M.A., D.Phil., Queen's College.

Assistant (part-time): R. Hanitsch, Hon. M.A.

Lectures and Laboratory Instruction

A course of ten lectures followed by laboratory work was given during Trinity Term to the students taking Honours in Zoology.

Research and Publications

Dr. Hobby has continued his work on Asilid flies, and on the Bornean Blattidae, but pressure of work in the library has prevented either of these studies from being completed. He has been assisted in the latter group by Dr. Hanitsch who, among other investigations, is still engaged on his monograph of the Blattidae of New Guinea.

Mr. E. P. Mumford (Jesus) continued his study of the origin and relations of the land and fresh-water fauna of the Marquesas Islands.

Accommodation was given to Mr. J. R. Carpenter (Lincoln), an advanced student; to Mr. D. E. Parker and Dr. J. M. Walter of the United States Department of Agriculture for their continued researches into Dutch Elm disease; and to Mr. J. Ford, B.A. (New College). The following publications during the year arose from, or concerned, the work of the Department: an asterisk (*) indicates that some or all of the specimens concerned are in the Department. Abbreviations for oft-recurring titles are as follows—

Proc. or *Trans.* *The Proceedings* or *Transactions of the Royal Entomological Society of London.*

E.M.M. *The Entomologist's Monthly Magazine.*

Brit. J., or *Brit. Tr.* *The Journal* or *Transactions of the Society for British Entomology.*

Ecol. *The Journal of Animal Ecology.*

Ann. Mag. *The Annals and Magazine of Natural History.*

The initials 'E.B.P.', 'G.D.H.C.', or 'B.M.H.' in brackets after the name of an author signify that the observations, or notes, were communicated, or the subject of comment, by the Emeritus Professor, the Professor, or Dr. Hobby.

Of General Interest

Coleman, Mrs. Edith (E.B.P.). 'Further observations on the pseudo-copulation of the male *Lissopimpla semipunctata* Kirby (Hymenoptera Parasitica) with the Australian orchid *Cryptostylis leptochila* F.v.M.' (*Proc.* A, *13*, 82–3, Pl. 1).*

Cornes, J. J. S., and the Professor. 'Attitude and Concealing Coloration' (*Nature*, *140*, 684).*

Cottam, R. 'A note on a thrush feeding its young on Emperor and Tiger Moths' (*Brit. J.*, *1*, 235–6).

Ford, E. B. 'Problems of heredity in the Lepidoptera' (*Biol. Rev.* *12*, 461–503).*

Heinrich, G. 'A List and some Notes on the Synonymy of the Types of the Subfamily Ichneumoninae Ashmead (Hymenoptera) in the Collections of the British Museum and the Hope Department of the Oxford University Museum' (*Ann. Mag.* (10), *20*, 257–79).*

Myers, J. G. (E.B.P.). 'The epigamic behaviour of the Termite *Microtermes sudanensis* Sjst. observed at Kagelu, Yei, Equatorial Province, Anglo-Egyptian Sudan. Economic importance of Termites to the native Azande' (*Proc.* A, *13*, 7–8).*

Poulton, E. B. 'The history of evolutionary thought as recorded in meetings of the British Association' (*Presidential address, British Association for the Advancement of Science, Nottingham*, 1937). 'Darwin Misunderstood' (Review in *Nature*, *141*, 807).

The Professor. Review of 'A Catalogue of the African Hesperiidae . . .', by W. H. Evans (*Entomologist*, *20*, 213–15). Obituary of R. J. Tillyard (*Proc. Linn. Soc. Lond.*, 1936–7, 212–18). 'Audible Emission of Defensive Froth by Insects' (*Proc. Zool. Soc. Lond.*, *108*, A, 243–52, Pls. 1, 2). 'Further Evidence that Birds do attack and eat Butterflies' (*Proc. Zool. Soc. Lond.*, *107*, A, 223–47, Pls. 1, 2).* 'Birds as Enemies of

Butterflies' (*South Eastern Naturalist and Antiquary*, *42*, 93–5, and Plate).* 'Wild Birds and Butterflies' (*Nature*, *140*, 974). 'Observations by Mr. R. E. Moreau on a nesting African shrike capturing butterflies' (*Proc.* A, *12*, 161–2). 'Lizards as enemies of butterflies' (*Proc.* A, *12*, 157–61, Pls. 1, 2).* '*Arctia plantaginis* Linn. (Lep.) eaten by Swifts: Tits feeding upon butterflies' (*Brit. J. 1*, 213–14). 'Birds seen to attack the Nymphaline butterfly *Anaea verticordia luciana* Hall' (*E.M.M.* *74*, 108–9).*

Uhman, E. '*Hispinen* aus dem Britischen Museum. 1. Teil' (*Proc.* B, *7*, 109–16).*

Waterhouse, G. A. (E.B.P.). 'Notes on Jones' Icones (Lepidoptera)' (*Proc.* A, *13*, 9–17).*

Palaearctic and Nearctic Regions

Brown, J. M. 'On some Collembola from Iceland and Greenland' (*Ann. Mag.* (10), *20*, 514–20).*

Cowley, J., and Gloyd, L. K. 'Redescription of the types of *Protoneura tenuis* Selys and a study of variation in this species' (*Occasional papers of the museum of Zoology, University of Michigan, No. 378*).*

Dowdeswell, W. H. 'Further notes on the Lepidoptera of Cara Island' (*Entomologist*, *70*, 169–75).*

Edwards, F. W. 'Oxford University Expedition to North-East Land, 1936. Diptera. With a Note on the Pupa of *Orthocladius conformis* Holmgr. by Aug. Thienemann' (*Ann. Mag* (10), *20*, 360–4).*

Jackson, A. R. 'Notes on Arctic Spiders obtained in 1933–1936' (*Proc. Zool. Soc. Lond.* B, *107*, 543–51).*

Poulton, E. B. '*Agdistis staticis* Millière (Lep., Pterophoridae) taken in Cornwall by Dr. C. H. Andrewes, M.D., F.R.E.S.' (*Brit. J.*, *1*, 230–1).

The Professor. 'Notes on Insects collected in North-west Greenland by the Oxford University Ellesmere Land Expedition, 1934–35' (*Ann. Mag.* (10), *20*, 401–9).* 'Notes on a Collection of Insects made by the Oxford University Arctic Expedition in West Spitsbergen, 1933' (*Ann. Mag.* (10), *20*,

411–15).* 'Notes on Insects collected in West Greenland by the Oxford University Greenland Expedition, 1936' (*Ann. Mag.* (11), *1*, 529–53).*

The Professor, and Hobby, B. M. 'On some European yellow forms of *Pieris napi* (L.) (Lep. Rhopalocera): a review of the literature' (*Entomologist*, *70*, 181–5, 204–10, 232–8).*

Taylor, E. 'Some records of bred Tachinidae (Diptera)' (*Brit. J.*, *1*, 221–3).*

Walker, J. J. 'On the Coleoptera, etc., of the Faroe Islands' (*E.M.M.*, *74*, 77–82).*

Other Regions

Beier, M. (B.M.H.). 'Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Mantodea' (*Proc.* B, *6*, 177–81).*

Hanitsch, R. 'Exploration du Parc National Albert. Mission G. F. de Witte (1933–1935). Fascicule 18. Blattids' (*Institut des Parcs Nationaux du Congo Belge* pp. 1–26).*

Kleine, R. 'Results of the Oxford University Expedition to Sarawak (Borneo), 1932. Brenthidae und Lycidae (Coleoptera)' (*Ann. Mag.* (10), *20*, 505–9).*

McNeill, F. A. (E.B.P.). 'Notes on the gregarious resting habit of the Danaine butterfly, *Danaus melissa hamata* W. S. Macleay, in the Whitsunday Islands off the coast of Queensland' (*Proc.* A, *12*, 108).

The Library

The policy of making the library a working one for the use of entomologists has been steadily pursued. Funds obtained by the sale of non-entomological books not required by the University Library or by other departments, and of entomological duplicates, have made it possible to continue dealing with arrears of bindings: one hundred and three volumes were bound as 58. Moreover, it has been possible to obtain aid, in his spare time, from Mr. F. L. Mitchell, assistant in the Radcliffe Library, with the collation of duplicates, and to continue employing Miss A. Z. Turner in card-indexing. Items numbering 7,659 have thus been catalogued during the year according to authors and subjects. Numerous non-entomological

books and pamphlets were transferred to other departments of the University: the Bodleian Library accepted 131.

The following data are supplied by Dr. Hobby:

1,600 books and separata were added to the library; these figures do not include numerous parts of periodicals given by the Emeritus Professor, the Professor, Professor L. W. Grensted, D.D., Commander J. J. Walker, R.N., Hon. M.A., and by other institutions. The largest donation was a fine set of reprints from Dr. Hanitsch containing nearly all the more important papers on Orthoptera published during the past 50 years.

The following are among the chief books acquired during the year, all by purchase except where otherwise indicated in brackets:

Comstock, J. H. (1936). *An introduction to entomology*. New York. 8th ed.

Dale, C. W. (1890). *The history of our British butterflies*. London. [J. J. Walker.]

—— (1891). *The Lepidoptera of Dorsetshire*. Dorchester. 2nd ed.

De la Torre-Bueno, J. R. (1937). *A glossary of entomology*. Lancaster. Penn.

Dognin, P. (1887–96). *Note sur la faune des Lépidoptères de Loja et environs (Équateur)*. Paris. 4 vols. in 1.

Ferris, G. F. (1937). *Atlas of the scale insects of North America*. Stanford. 1st ser. [J. J. Walker.]

French, G. H. (1886). *The butterflies of the eastern United States*. Philadelphia.

Imhoff, L. (1856). *Versuch einer Einführung in das Studium der Koleoptern*. Basel. [J. J. Walker.]

Korschelt, E. (1924). *Der Gelbrand Dytiscus marginalis L.* Leipzig. 2 vols.

Melander, A. L. (1937). *Biological terms*. New York.

Piepers, M. C., and Snellen, P. C. T. (1909–10). *The Rhopalocera of Java*. The Hague. 4 vols. in 1.

Plate, L. (1913). *Selektionsprinzip und Probleme der Artbildung*. Leipzig.

Reinig, W. F. (1937). *Melanismus, Albinismus und Rufinismus.* Leipzig.

Strecker, H. (1872). *Lepidoptera, Rhopaloceres and Heteroceres.* Reading, Pa.

Toxopeus, L. J. (1930). *De soort als functie van Plaats en Tijd Getoetst aan de Lycaenidae van het Australaziatisch Gebied.* Amsterdam.

Verity, R. (1905–11). *Rhopalocera Palaearctica.* Florence.

Wilson, H. F., and Doner, M. H. (1937). *The historical development of insect classification.* St. Louis.

Donors of some of the larger gifts of separata are enumerated below:

H. E. Andrewes, 8; H. Audcent, 21; R. N. Chrystal, 3; A. Cuthbertson, 3; C. S. Elton, 4; C. Ferrière, 4; A. H. Hamm, 48; R. Hanitsch, 777; A. C. Hardy, 3; F. B. Hindle, 6; F. Heikertinger, 5; B. M. Hobby, 165; A. D. Imms, 5; F. le Cerf, 3; W. S. Patton, 73; E. B. Poulton, 35; The Professor, 22; F. Steiniger, 10; H. Stempffer, 4; F. B. Sumner, 8; R. J. Tillyard, 3; J. J. Walker, 23; G. Warnecke, 16; H. Womersley, 13.

In addition, the Trustees of the British Museum (Nat. Hist.), Cornell University, Harvard College, Imperial Agricultural Research Institute (New Delhi), Johns Hopkins University, Rothamsted Experimental Station, Secretary of State for India, Taihoku Imperial University, United States Department of Agriculture, and other bodies have kindly continued their gifts of entomological publications. Ninety-eight separata were purchased; these included valuable sets of papers on cavernicolous insects and the fauna of the Galapagos Islands.

Important Additions to the Collections

The following are the total additions for the year:

Lepidoptera	8,070
Coleoptera	290
Diptera	274
Trichoptera	157
Hymenoptera	153
Miscellaneous	1,482
Predators and prey	308
Total	10,734

The large figure under 'Miscellaneous' is mainly due to the collection of species bred from elm logs and given by Mr. Parker, not yet classified; about 1,000.

As usual, butterflies form the bulk of the additions, chiefly from three sources. (1) Mr. T. H. E. Jackson, F.R.E.S., of Kitale, Kenya Colony, who has continued a long list of previous benefactions by presenting massive collections from forests on the west shore of Lake Victoria and in West Uganda; there are most interesting differences between various patches of forest, residual islands from a former sea. Very large numbers of specimens still remain in papers, to be examined and selected. (2) By purchase, 560 specimens from the Cameroons, nicely supplementing last year's purchase, and filling a void of long standing. (3) Colonel H. C. Winckworth who, with his brother Mr. R. Winckworth, has generously given six cabinets containing a representative series of species from South India. The gift is the more acceptable as it involved no work for the department, the 5,095 perfect specimens being arranged and named so as to form an invaluable reference collection for South India.

A notable addition to the specimens used in teaching was a very fine specimen of the primitive *Megajapyx* kindly given by Professor Silvestri.

The British Collections

Aubrook, E. W.—2 *Oecetes lacustris*, a Caddis-fly new to the collections; another species, *Oecetes testacea* new to Oxfordshire, and *Phryganea varia* new to the Oxford district. Also a long series of the Caddis-fly, *Setodes lusitanica*, first discovered in Britain by Professor Grensted. A rare Drosophilid fly, *Leucophenga maculata*. 10 bred specimens of the moth *Callimorpha dominula* of the variety *medio-nigra*, from a female parent of the form *bimacula*, taken at Cothill by W. F. Burrows.

Balfour, Henry.—50 Geometrid moths, including the two first-known British specimens of *Acidalia immorata*.

Bartindale, G. W. R.—24 Sawflies from near Oxford.

Britten, H.—14 specimens of an undescribed, though probably common, species of fly near *Pollenia rudis*: from Staffordshire.

Donisthorpe, H. St. J.—99 specimens, mainly beetles from Windsor Forest. 13 species are new to the great collection from this locality, bringing the total number of species known to 1,653. Also *Scymnus pulchellus*, a rare beetle from Kent and Suffolk.

Donovan, C.—A specimen of each of the following forms of *Pieris napi*, not represented in the collection, from Ireland: *vidua* Donovan, *radiata* Röber, *interjecta* Röber.

Evans, G. H.—20 insects from the Channel Isles.

Freeman, R. B.—2 specimens of the ant *Strongylognathus diveri*, recently described as new to science, from Dorset.

Goffe, E. R.—A rare Tachinid fly from Hants, *Lophosia fasciata*, new to the collection.

Grensted, L. W., and A. D.—154 specimens, mainly Trichoptera, of which 9 species were new to the collections and one, *Setodes lusitanica*, from the Thames, new to Britain. Also a number of Perlidae, a group poorly represented in the collections. From Oxfordshire and Somerset.

Hamm, A. H.—Co-types of the Braconid *Apanteles melitaearum*, and other species of the same genus from Oxford: 14 specimens.

Harrison, J. W. Heslop.—12 hybrid moths bred from parents *Biston hirtaria* and *B. lapponaria*.

Latham, H.—The Scorpion-flies *Panorpa germanica* and *P. communis* from Argyllshire; not previously represented from Scotland in the collections.

The Professor.—182 insects from north Cornwall, a locality not well represented: a specimen of *Pterostichus angustatus*, a beetle probably new to Dorset.

Taylor, E.—193 specimens, including a series of Tachinid flies bred from woodlice.

Vevers, H. G., and Evans, F. C.—87 Coleoptera and Diptera from the Faeroe Islands.

Specimens have also been received from Burrows, W. F., Collins, J., and the Imperial Institute of Entomology.

Palaearctic Region, excluding Britain

Bänninger, M.—7 named Carabids, genus *Nebria.*

The Professor.—350 specimens of various orders from the Rhone delta, including the rare Acridian, *Prionotropis hystrix rhodanica,* a relic of an ancient desert fauna.

Ethiopian Region

Ellison, R. E.—11 butterflies from Abyssinia, including 8 species or forms of Lycaenidae new to the collections.

Government Entomologist, Uganda.—A Hesperiid butterfly, *Zenonia crasta,* new to the collections.

Jackson, T. H. E.—1,143 butterflies from various localities in Uganda, greatly enriching the mass of material already sent by him and available for study of geographical variations in that interesting area; among other rarities is included a series of *Anthene iturina.* 27 rare butterflies from Uganda, including the following species new to the collections, *Cymothoë zenkeri, Pseudathyma callina,* paratypes of *Diestogyna chalybeata, Mylothris solilucis,* an *Epamera* and a *Deudorix* not represented in the British Museum; and *Alaena kagera* from Ngong, Kenya, a locality far removed from that of the type, which is the only specimen in the collections. Also, from Mt. Elgon, a form of *Euxanthe eurinome* near to form *celadon,* new to the collections. 69 bred Lycaenidae, with pupal skins.

Mason, C.—640 butterflies from Nyasaland, including *Mimacraea costleyi* new to the collections, and the rare form *punctellata* of *Acraea nohara.*

Platt, E. E.—7 specimens of *Charaxes xiphares* from Natal.

Wood, R. C.—37 butterflies from Nyasaland.

Other Regions

Fraser, F. C.—223 butterflies from South India, carefully selected and with good data including the very rare Satyrine *Parantirrhaea marshalli* damaged by an enemy, probably a bird. It is an appropriate occasion to remark here that until help can be found it is impossible for the present staff to do more than

see to the setting and labelling of these valuable accessions. The Indian region is now, after the Ethiopian region, the area best represented in the collections, and voluntary help would be exceedingly welcome in order that the mass of material may be properly utilized.

Latham, H. A.—38 Asilid flies from New Zealand, including about six species.

Winckworth, H. C.—The most useful key collection presented with its cabinets has been already noted.

Specimens have also been received from R. A. Lever.

Accessions of Special Bionomic Interest

Main, H.—7 flies, *Gaurax araneae*, bred from the egg-sacs of the 'Black-widow' spider, *Latrodectus mactans.*

Parker, D. E.—About 1,000 specimens of insects of many orders reared from elm logs at Studley, Oxon.: a collection made during the investigations on behalf of the U.S. Department of Agriculture into the Dutch Elm disease.

Taylor, E.—A series of the Chalcidid *Mormoniella vitripennis* bred from puparia of the Tachinid parasite of earwigs, *Digonochaeta spinipennis.*

Accessions to the special collection of wings of moths dropped by bats when feeding have been received from Hobby, B. M., and from Moreau, R. E., from Kilimanjaro.

Predators with Prey

Andrewes, C. H.—A Tettigoniid found devouring a *Zygaena filipendulae*: it is possible that the moth was dead when found by the grasshopper.

Cowley, J.—13 dragonflies with prey.

Goffe, E. R.—22 Asilid and Empidid flies with prey.

Hamm, A. H.—9 Empididae with prey.

Jackson, T. H. E.—30 Asilidae and prey from Kenya Colony.

Pugh, C. H. W.—20 specimens comprising Empididae and Dolichopodidae, the latter with small larvae. Very little is known of the prey of Dolichopodid flies.

Richards, O. W.—The following Hymenoptera with prey, 74 specimens: *Psenulus atratus* with Aphidids, *Rhopalum clavipes* with Psocids, and sundry wasps with spiders.

Varley, G. C.—29 Reduviid bugs and Asilidae with prey, from California.

Butterflies attacked by Birds

The unique special collection of butterflies with wings marked by the imprint of birds' beaks grows steadily. The catalogue now indexes 262 examples, collected since the publication of the Professor's last paper on the subject in 1937: many more await cataloguing. During the year 106 specimens have been received from the following kind donors; this number includes a few specimens seen to be attacked: Bletchly, J. D.; Booth Museum, Brighton, through the Curator, Major H. Blackiston, 18; British Museum, Natural History, Trustees, by exchange, 13; Bull, G. V., 7; Cother, A. W.; Cox, W. E., 4; Henstock, H.; Jackson, T. H. E.; Jannings, Miss C. M.; Moreau, R. E.; Sheppard, P. M.; Tring Museum, 49.

Butterflies attacked by Lizards

The attention paid to 'beak-marks' of birds has resulted in the discovery that lizards also make marks upon the wings of butterflies which escape after having been seized: the shape of the imprint of their jaws is quite diagnostic. A separate collection is being formed of these interesting specimens which are much scarcer than those bearing beak-marks. At present the collection only numbers 13, of which 2 have been received during the present year from the following donors; Jannings, Miss C. M., a 'Red Admiral' bearing an imprint suggesting that the aggressor had been a Green Lizard (this butterfly, captured on the south coast, was therefore probably an immigrant from the Channel Islands or the south of France); Simes, J. A., *Melitaea athalia* from the south of France.

A moth, *Lymantria curvipes*, from the Philippine Islands has also been given by the Trustees of the British Museum (Nat. Hist.) showing a very clear imprint of a lizard's jaws.

General Remarks

The most important single piece of work that has been done this year was the bringing together and rearranging by Mr. Taylor of all the specimens from the Pacific Islands, formerly scattered through various cabinets and boxes: these are now readily available for study. A grant from the Museum Delegates made possible the purchase of two new cabinets of standard type and two large second-hand cabinets were also purchased. Two exhibits were arranged in the court of the museum for the public: butterflies of the Oxford district, and immigrant Lepidoptera. It was a great pleasure to see the Emeritus Professor preside over the British Association at Nottingham in September. Sir Edward has constantly visited the department during the year, and his help and kind advice have been frequently sought.

Commander J. J. Walker, R.N., Hon. M.A., kindly continues to help in many ways, especially with proof-reading.

Professor L. W. Grensted, D.D., has very greatly increased the collection of Trichoptera, and other less popular orders.

The Professor has given lectures to several societies, and demonstrated in the department to parties of boys from Stowe and Bradfield the work that is done in connexion with the study of natural selection. The University Entomological Society continued its regular terminal meetings, Mr. G. H. Thompson (St. Edmund Hall) being secretary. A successful joint meeting with the sister society from Cambridge was held in Trinity Term, four guests attending and staying two nights.

The work of Mr. E. P. Mumford on the problems of island faunas in the Pacific has received welcome support from various sources, and it is a great pleasure to acknowledge here the continued helpful interest shown by Mr. B. Ewart White through whom financial assistance from private benefactors has been forthcoming, and promised. The Royal Society, and Section D of the British Association at this year's meeting, have given grants, and the Trustees of the Higher Studies Fund of the University have recommended that £150 a year for five years be contributed, subject to approval by Congregation in October.

As usual, many naturalists have visited the department, often to see types; other types have been sent away to specialists, and received back without damage.

The following names are selected from the 51 in the Visitor's Book:

Arrow, G. J. (British Museum, Nat. Hist.); Banks, E. (Curator, Sarawak Museum); Bodenheimer, F. G. (Hebrew University, Jerusalem); Bucknill, E. G.; Chamberlin, R. V. (University of Utah); Duke, H. L.; Ellison, R. Eldon (H.B.M. Consul, Harar, Abyssinia); Frost, Florence M. (University of California); Flexner, Simon (Eastman Visiting Professor); Glauert, L. (Western Australian Museum); Oldroyd, H. (British Museum, Nat. Hist.); Punnett, R. C. (Cambridge); Pott, R. H. (Stowe); Qadri, M. A. (Aligarh Muslim University); Sasscer, E. R. (Bureau of Entomology and Plant Quarantine, Washington); Strong, Lee A. (Chief of the same Bureau); Trehan, K. N. (Agricultural Research Institute, Lyallpur); Wood, H. (Bradfield).

G. D. HALE CARPENTER.

7

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxii.

A note on the behaviour of New Zealand birds towards the Cinnabar moth (*Tyria jacobaeae* L.).—An interesting article by Ewen Cameron (1935, J. Ecology **23**, pp. 265-322) on the control of Ragwort and other foreign weeds which have become pests in New Zealand, resulted in my writing to Dr. D. Miller, Chief of the Entomological Department of the Cawthron Institute, to ask if there were any observations as to the behaviour of insectivores in New Zealand to the Cinnabar moth (*Tyria jacobaeae* L.) which had been introduced to cope with the Ragwort.

According to Cameron, who had studied the enemies of this insect in England, the effect of predators is felt only in the pupal stage, since the black and yellow larvae are distasteful to birds: the mole is considered to be the most important predator, and at least 60 per cent. of the insects are destroyed as pupae. In response to enquiry Dr. Cameron kindly wrote to me, 'I have never observed the larvae to be attacked by birds, although I have been in the field a great deal during the season when larvae are plentiful. When I tried to feed the pupae to a large flock of game birds, chiefly pheasants, it was with difficulty that I could get them to eat any at all.'

The following observations which Mr. J. M. Kelsey of the Cawthron Institute kindly sent me, are therefore of interest.

'12*th May*, 1936.

DEAR SIR,

Dr. Miller has asked me to supply you with any information we have available in regard to New Zealand birds in relation to *Tyria jacobaeae*.

On two occasions the common house-sparrow, *Passer domesticus*, was seen eating adult moths. The first case was of a sparrow eating a moth on the ground, and the second of a sparrow capturing the moth while both were in flight, the bird retiring to a nearby tree to devour its capture.

To secure supplies of *Tyria* eggs for distribution it was necessary to grow plots of ragwort in the Institute grounds, the adult moths being enclosed in muslin bags stretched on wire frames and placed over ragwort plants.

From time to time it was noted that some bird had been robbing the muslin cages of the adult moths, and though no one has actually seen the robbery taking place, numbers of small round holes were seen with pieces of moth-wings stuck in the threads of muslin surrounding them. It is not known what bird was responsible, but numbers of the common house-sparrow were frequently observed perched on the cages and on the ground near them.

In regard to birds attacking the caterpillars. I cannot say definitely that the bird was the same one each year, but during the years 1931 to 1933 a shining cuckoo, *Lamprococcyx lucidus*, appeared each spring in the plots to feed on the brightly coloured *Tyria* caterpillars. There was a low post in one of the beds on which the bird used to perch and from which it flew down to secure a caterpillar which it brought back to the post and devoured. Towards noon the bird was usually found on the ground in the plots too gorged with

caterpillars to bother about returning to the post, and taking to flight only when a worker approached quite close to it, when it usually flew about ten feet away to settle again. On several occasions larvae were seen hanging from one side of the beak, the bird being unable to swallow any more, though making heroic attempts to do so.

One or two farmers on whose properties the insect had been liberated took considerable interest in the development of the caterpillars, and were surprised at the sudden disappearance of these over wide areas; the only reason they could give for this was that they had been eaten by the imported starling, ***Sturnus vulgaris,*** large numbers of which appeared in the areas where the insect had been liberated. None of these observers actually saw the starlings eating the caterpillars, but since the latter were present in various stages of development prior to the arrival of the birds, and as they could find practically no caterpillars on the departure of the birds after a few days, they concluded that these were responsible.

Apart from the cuckoo no native birds have been recorded as feeding on either larvae or adults of *Tyria jacobaeae*.

Yours faithfully,

J. M. Kelsey, *Assistant Entomologist.*'

The closing sentence of Mr. Kelsey's letter is of considerable value, for it once again adduces evidence of the peculiarities of cuckoos. The cuckoo of the country is known to feed upon hairy and other caterpillars disliked by other birds (see, for example, 1935, Proc. R. Ent. Soc. London, **10**, p. 81).

But the fact that two species of British birds introduced into New Zealand appear there to attack freely an insect which they are not known to attack in their native country is of quite as much interest, and suggests that further enquiry would be valuable.—G. D. Hale Carpenter, Hope Professor, Dept. of Entomology, University Museum, Oxford: *June 19th*, 1936.

8

Reprinted from *South Eastern Naturalist and Antiquary*, Vol. XLII, pages 93-95, 1937.

Birds as Enemies of Butterflies

BY

Prof. G. D. HALE CARPENTER, M.B.E., D.M., B.Ch., F.R.E.S., F.L.S., F.Z.S.

(*Delivered June 11th,* 1937)

The question whether birds do or do not eat butterflies has more in it than appears, and the answer is important. For it is claimed by some that if birds do not eat butterflies the interpretation of the phenomena of Mimicry (but in butterflies only) falls to the ground. The current theory rests on the food preferences of birds which cause them to reject as distasteful such butterflies as have " warning colours " and consequently to reject also others which, superficially resembling the former, are known as " Mimics." The weakness of the argument against this theory lies in the fact that butterflies are not the only mimicking insects, and the theory of mimicry would be little damaged even if it could be proved that no bird ever ate a butterfly!

Although the question of mimicry does not enter into the question in England, it can scarcely be doubted that if birds eat butterflies here they do so elsewhere. Consequently members of the South-Eastern Union can render service to science by helping to provide evidence on this point: this is of three kinds:—

1. Direct observation. Ornithologists can help by watching parent birds bringing food to their young. Even so unlikely a bird as the Chaffinch has been seen, several years running, to feed its young with the powerfully flying Silver-washed Fritillary, *Argynnis paphia L.* Observation of Flycatchers when teaching their young to catch insects has yielded very interesting results. Bushes such as *Buddleia* frequently attract birds to feed on the thronging butterflies and the bitten-off wings may be found underneath.

2. Beak-injuries. Butterflies are often seen with pieces missing from the wings: if the injuries are symmetrical on the two sides they may have been inflicted by the snap of a bird's beak. An observer sometimes actually sees the piece bitten out and hears the snap of the beak. Such damaged specimens are of greater scientific value than the most perfect " cabinet specimens." and should not be discarded

3. Beak-marks. The edges of the beak may leave a ʌ-shaped impression by denuding the wings of scales. Such marks, on upper and under surface, are frequently very clear but may be faint and only visible by transmitted light.

The writer appeals to naturalists to send observations or specimens to him at the University Museum, Oxford.

Do Birds Eat Butterflies?

There is more in this question than meets the eye. It is of greater importance in the tropics, where mimicry of a distasteful butterfly by another less distasteful species, or resemblance between two or more highly distasteful species, are considered to be due to the selective preference of birds. That birds eat butterflies is doubted by critics of the theory of Natural Selection.

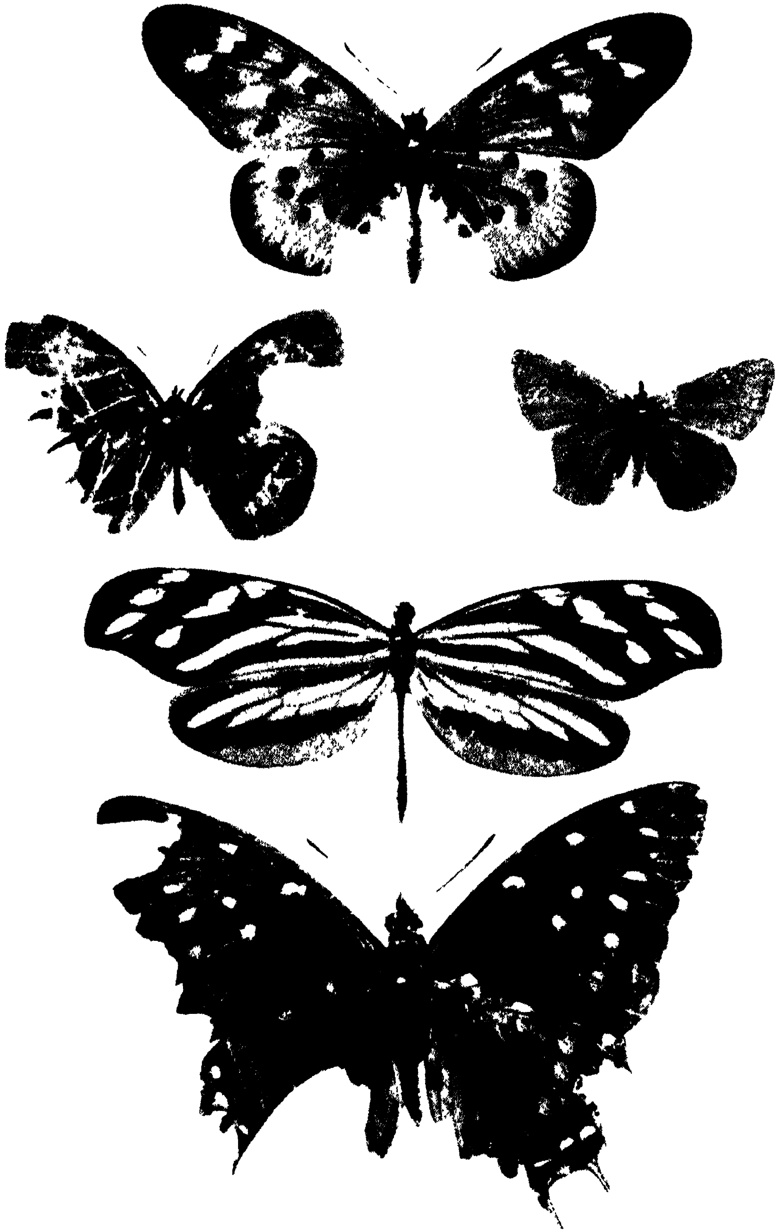
Although the question of mimicry does not arise in the case of English butterflies, observations in England can at least help to show that birds do eat butterflies. Naturalists are asked to communicate any field observations to Prof. Hale Carpenter, addressed to the University Museum, Oxford, with data as complete as possible, giving time and place and as close an approximation to the name of the bird and butterfly as can be made. Collectors who obtain specimens with " beak-injuries " or " beak-marks," as illustrated in the accompanying plate, are asked to send them to add to the collection of evidence being accumulated at Oxford in the Hope Department of Entomology. The top specimen is No. 1.

Description of Plate.—The specimens shown are all in the Hope Department of Entomology, University Museum, Oxford, and appear Natural Size.

1. *Acraea pharsalus* Ward. Female Forest on west coast of Lake Victoria, Uganda, August, 1935. T. E. H. Jackson.—Beak-mark on left hind wing pointing forwards and outwards.

2. *Aphantopus hyperantus* Linn. (Ringlet), Female. Aston, Herefordshire. July 19, 1936. J. F. D. Fraser.—The large number of beak-marks in different directions suggest that the butterfly was captured by the same bird and got away many times: perhaps it was being played with or the bird was not hungry enough to eat it. Large portions of the wings are missing.

3. *Polyommatus icarus* Rott (Common Blue). Male. Madingley, Cambridge, July 2, 1935. G. C. Varley.—Beak-mark crosses tip of left front wing obliquely from front backwards: the tip of the beak was beyond the outer marking of the wing.



Natural size *[Photo by Imperial Forestry Institute, Oxford.*

SPECIMENS OF BUTTERFLIES, SHOWING BEAK-MARKS.

Hope Department of Entomology, Oxford University.

The costal (anterior) margin of the wing is broken by the inner limb of the mark, which has nearly cut through the wing.

4. *Dismorphia praxinoë* Doubl. Female. Chiriqui, Panama Central America.—There is a mark on both hind wings, clearest on right. The wing has evidently been doubled up when seized, as the mark is duplicated to make a diamond shape. This is a typically mimetic butterfly, one of the group which first attracted the attention of H. W. Bates.

5. *Charaxes etesipe* Godt. Male. Semliki Valley, Western Uganda; July 25, 1931. G. D. H. Carpenter and C. A. Wiggins. —Beak-injuries on both sides and a clear beak-mark on the left front wing, running forwards and inwards from the posterior angle.

BIRDS SEEN TO ATTACK THE NYMPHALINE BUTTERFLY *ANAEA VERTICORDIA LUCIANA* HALL.

BY PROFESSOR G. D. HALE CARPENTER, D.M., F.L.S.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiv.

Mr. A. Hall has kindly sent me the following notes. 'When in St. Lucia in 1930 I wanted to get a series of *Anaea verticordia luciana* Hall, a race peculiar to the island.

'Like others of its genus it has a habit of settling on the branches of trees in preference to the leaves. I found a spot where it was fairly common but my efforts to catch it were at first hindered by certain small brown birds, about the size of Robins, which lurked among the bushes and darted at the butterflies just as they had settled or were about to do so. These birds were so persistent that eventually I kept a pile of small stones handy to throw at them. In the end I got a good series of the butterfly but more than fifty per cent. were damaged like those I am sending you, and most of the others to a smaller extent, very few being perfect.

'The butterflies of this group seem to lose part of their hind wings very easily. Once in Venezuela I saw a fine specimen of an allied species, *Hypna rufescens* Butler, settle on a bush when I had no net with me. I tried to take it in my fingers and in fact did so, but to my dismay the insect gave a sort of sudden jerk and flew away, leaving nearly half its hind wings between my finger and thumb. Probably they escape from birds and lizards in this way, as the wings of the much less robust Ithomiinae and Pieridae would never break off like that.'

In response to enquiries, Mr. Hall kindly wrote again as follows: 'I did not actually see the birds catch the butterflies; the movements of both were rather swift and at the time I was too intent on getting the butterflies myself to regard the birds as anything but a nuisance. When bird and butterfly disappeared simultaneously I assumed that the latter had been caught.

'The attacks can hardly have been in sport, as other, commoner, and slower-flying butterflies like *Precis lavinia* Cr. and *Anartia jatrophae* L. did not seem to be molested.'

The toughness of Ithomiinae, and other typically aposematic insects such as Acraeinae and Euploeinae, is well known to collectors. An interesting confirmation is that in the collection of beak-marked specimens which I am making at Oxford, and in which Ithomiinae form a very high percentage of cases from South

America, injury of the wings to a degree at all serious, is quite exceptional. I have no specimens showing the deep V-shaped gap often seen in Lycaenidae or Nymphalines. It is also noteworthy that the supposedly distasteful Ithomiinae form a very high percentage of the total number of beak-marked South American specimens: these, be it noted, are specimens which have *escaped* from attack, practically uninjured.

The fourteen specimens of *Anaea* which Mr. Hall kindly sent have all had damage inflicted upon the hind wings, more or less symmetrically, sometimes also involving the front wings. The tails of the hind wings are missing from all except five specimens. The damage is in no case such that it must, obviously, have been inflicted by the beak of a bird which often leaves a narrow, deep, Λ-shaped gap in a wing. The hind margins are irregularly or raggedly broken away: such damage might easily, and with justice, be ascribed to the broader mouth of a lizard.

Dept. of Entomology,
Oxford University Museum.
March 25th, 1938.

10

[*Reprinted from the 'Journal of the Society for British Entomology,' Vol. 1, Part 8. Date of publication, 31 March, 1938.*]

Arctia plantaginis Linn. (Lep.) eaten by Swifts.

Mr. T. W. Kirkpatrick, of the Agricultural Research Station, Amani, East Africa, recently sent me the following observation, through Dr. C. B. Williams, of Rothamsted, to whom I am greatly obliged:

'On June 26, 1937, I was on Wetherlam, near Coniston, about 2,000 ft., and for half-an-hour sat watching swifts catching *Arctia plantaginis*. The moths were very common, but not flying much, but when they did a swift was after one at once and usually got it. There were very few other large insects about, except a few 'Small Heaths' and a brown butterfly I had not seen before, *Erebia epiphron* Knoch, I think. I did not see either of these attacked.'

This observation seemed to me sufficiently interesting to be worth enquiry, and I wrote to Mr. Kirkpatrick, who kindly gave the following information:

'The moth was common or abundant in most suitable places between about 1,000 to 2,300 feet during June 20th-29th. I don't know if this is so in all years. Time of day, about 2.30-3.0 p.m. (summer time). Bright sun, almost cloudless. Temperature probably not much over 60° F., but felt warmer. Wind S.W., rather fitful, say 5-15 m.p.h. I *think* the moths were only flying much when an extra strong gust (or someone walking through the grass) disturbed them. The ground was very broken, so that a few yards from starting a flight a moth might be many feet up in the air without actually having flown upwards. The butterflies mentioned were flying in the same way, but I should estimate there was only one of them to about ten *plantaginis*. The swifts were catching them at all levels between one and at least fifteen feet from the ground. My impression is that they more often missed the ones close to the ground.

'Although *plantaginis* was more or less all over the place I did not see swifts catching them (or anything else) anywhere else in the hills. There were about seven or

eight swifts but they were making wide sweeps and it was difficult to be quite sure of the number.'

This seems to be a case of the provision of an abundant article of food at a particular spot favouring its capture. It is, therefore, hardly surprising that the swifts, probably with young to feed, should have made the most of it.

G. D. HALE CARPENTER.

Tits feeding upon Butterflies.

Mr. F. Dowsett has sent me the following interesting note: 'Close to where I sit at work is a radiator, behind which a pair of Great Tits have nested. They obtain entrance by means of a grating on the outside wall. Last week I happened to glance out of the window and saw one of the birds with a *Pieris* in its beak. I was very interested. The rest of the week I glanced up from my work occasionally with the following results. On May 26th I saw them take 12 specimens to the nest, on the 27th they took 11, on the 28th I noticed 15 (5 of these in about ten minutes), and on the 29th I counted 14 during the morning only. In addition, they took many larvae. Before going to the nest they invariably perched on a Buddleia for a few seconds, so I got a good view. In every instance the whole specimen was taken, and although I searched for wings I was unable to find a trace of one. As far as I could tell, the insects were *Pieris brassicae* L. and *P. rapae* L. I noticed that the insects were held by the body with the wings closed, from which I had the impression they were taken while at rest. There were plenty of *Pieris* about, but the birds made no attempt to take them in flight.'

After the young had flown Mr. Dowsett removed the grating, but found no wings in the nest: presumably they had been removed by the parents or, less probably, the whole insect had been swallowed.

In this connection an old observation may be quoted, for which I am indebted to Mr. W. B. Alexander.

E. Jesse, in 1835, 'Gleanings in Natural History,' London, 3rd series, p. 94, wrote: 'Tom-tits catch and feed upon the early butterflies. They lay hold of them as I have often observed with their feet.'

G. D. HALE CARPENTER.

11

[Reprinted from the 'Journal of the Society for British Entomology,' Vol. 1, Part 8. Date of publication, 31 March, 1938.]

A note on a thrush feeding its young on Emperor and Tiger Moths.

The following observations are intended to be a contribution to the subject of birds attacking or eating bright coloured insects. I have been breeding Emperor Moths on a large scale for four years with the object of increasing the species on Lindow Common, Wilmslow, Cheshire. This summer I discovered an ingenious way of utilising the 'spent' specimens, males and females, by offering them to a cock thrush which has been a regular visitor to my house for three full years. It was during the nesting period and the bird was naturally occupied in finding sufficient food for four young birds. Every moth was deliberately taken from my fingers and tapped on the ground until the wings were broken off. Invariably the bird waited until it had three or four moth's bodies at a time, some being left on the ground until the others were devoid of their wings. This was a usual procedure and a daily occurrence

during the period of the emergence of my Emperor Moths. I must have used up nearly three hundred of these moths in supplying food to the thrush. With regard to Tiger Moths (*Arctia caja* L.) the bird has taken about twenty individuals and treated them in the same way. There is one point I must mention. The thrush is exceedingly tame and has been fed upon table scraps and worms for about three years. I cannot remember, however, that except in the case of the moths, any food has actually been taken from my fingers. It would appear that the moths are a tempting food for thrushes. Although I have often seen birds chasing male Emperor Moths on Lindow Common, I have not seen any of them being captured.

R. COTTAM.

Reprinted from *The London Naturalist* for 1936, the Journal of the London Natural History Society, The London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1.

Predacious Flies and Their Prey.

By L. Parmenter, F.R.E.S.

THE fact that some species of flies feed upon other insects has been known for many years; Asilidae, Empididae, some Anthomyiidae and Cordyluridae, and species of other families having been recorded with the habit. The methods of capture and related biology of the Asilidae have been described by, amongst others, D. Melin and B. M. Hobby. It was the writings of these two naturalists that led me to collect Diptera with their prey, a fascinating study to be commenced in almost any hedgerow, etc., in the warmer months.

The captors and victims listed below were taken by myself with the exception of the two obtained by Messrs H. J. Burkill and G. Waller. Help in identification of the prey has been kindly given by Messrs R. L. Coe, J. E. Collin and Drs K. G. Blair, M. Burr and F. W. Edwards, to whom my thanks are due. I am also indebted to Dr B. M. Hobby for assistance in the preparation of this paper. All the specimens have been presented to the Hope Department of Entomology, Oxford University Museum, where there is a very extensive collection of predatory insects and their prey.

In the following list the sex of the captor precedes the name of the prey.

PREY OF DIOCTRIA OELANDICA L. (ASILIDAE).
(1 ♀)

DIPT., EMPIDIDAE.

♀. *Empis grisea* Fln., ♀ (det. J.E.C.), Ranmore Common, Surrey, 23/6/35.

PREY OF PHILONICUS ALBICEPS MG. (ASILIDAE).
(1 ♀)

DIPT., SYRPHIDAE.

♀. *Chilosia intonsa* Loew, ♂, Lelant, Cornwall, on bare sand of towans, 28/8/36.

PREY OF ASILUS CRABRONIFORMIS L. (ASILIDAE).
(4 ♀♀)

ORTH., ACRIDIIDAE.

2 ♀♀. *Chorthippus bicolor* L., 2 ♀♀ (det. M.B.), Lelant, Cornwall, on grass track of towans, 28/8/36.

COL., STAPHYLINIDAE.

♀. *Philonthus aeneus* Rossi, ♂ (det. K.G.B.), Lelant, Cornwall, on towans, 28/8/36.

DIPT., TACHINIDAE.

♀. *Sarcophaga carnaria* L., ♂, Lelant, Cornwall, on towans, 28/8/36.

PREY OF NEOITAMUS CYANURUS LOEW (ASILIDAE).

(1 ♂, 1♀)

DIPT., TIPULIDAE.

♂. *Pachyrrhina ambeculosa* Mg., ♂ (det. F.W.E.), Bodmin district, Cornwall, 20/8/36.

♀. *Tipula cava* Ried., ♂ (det. F.W.E.), Oxshott, Surrey, on bracken, 11/7/36.

PREY OF EMPIS TESSELLATA F. (EMPIDIDAE).

(6 ♂♂)

DIPT., BIBIONIDAE.

2 ♂♂. *Dilophus femoratus* Mg., 2 ♂♂, Cuckmere Valley, Sussex, on hawthorn blossom, 28/5/36.

TIPULIDAE.

♂. *Pachyrrhina maculosa* Mg., ♂ (det. F.W.E.), Patcham, Sussex, 25/5/36.

EMPIDIDAE.

♂. *Pachymeria femorata* F., ♂, Patcham, Sussex, 25/5/36.

SYRPHIDAE.

♂. *Syritta pipiens* L., ♂, Polegate, Sussex, 30/5/36.

CORDYLURIDAE.

♂. *Scatophaga stercoraria* L., ♀, Polegate, Sussex, 30/5/36.

PREY OF EMPIS LIVIDA L. (EMPIDIDAE).

(1 ♂)

DIPT., DOLICHOPODIDAE.

♂. *Dolichopus aeneus* De Geer, ♂ (det. J.E.C.), Mitcham Common, Surrey, 7/7/36.

PREY OF PACHYMERIA FEMORATA F. (EMPIDIDAE).

(1 ♀)

DIPT., BIBIONIDAE.

♀ (in cop. with ♂). *Dilophus femoratus* Mg., ♂, Patcham, Sussex, 25/5/36.

PREY OF SCATOPHAGA STERCORARIA L. (CORDYLURIDAE).

(11 ♂♂, 15 ♀♀)

DIPT., BIBIONIDAE.

1 ♂, 3 ♀♀. *Dilophus femoratus* Mg., 4 ♂♂, Patcham, Sussex, hedge-bank, on umbellifers, 24/5/36.

2 ♂♂. *Dilophus femoratus* Mg., 2 ♂♂, Patcham, Sussex, 25/5/36.

4 ♂♂, 2♀♀. *Dilophus femoratus* Mg., 6 ♂♂, Patcham, Sussex, 27/5/36.

♀. *Dilophus femoratus* Mg., ♂, Cuckmere Valley, Sussex, 28/5/36.

♀. *Dilophus femoratus* Mg., ♂, Patcham, Sussex, 31/5/36.

RHAGIONIDAE.

♀. *Rhagio lineola* F., ♂, Bodmin, Cornwall, 20/8/36.

EMPIDIDAE.

♀. *Empis caudatula* Loew, ♂ (det. J.E.C.), Patcham, Sussex, 25/5/36.

SYRPHIDAE.

♂. *Platychirus albimanus* F., ♀ (det. L.P.), Beckenham, Kent, 14/6/36, G. Waller.

♀. *Platychirus scutatus* Mg., ♂, Mitcham Common, Surrey, 26/7/36.

♀. *Melanostoma mellinum* L., ♀, Bodmin, Cornwall, 20/8/36.

ANTHOMYIIDAE.

♂. *Pegohylemyia fugax* Mg., ♂ (det. J.E.C.), Patcham, Sussex, 29/5/36.

♀. *Pegohylemyia fugax* Mg., ♂ (det. J.E.C.), Polegate, Sussex, 30/5/36.

♀. *Pegohylemyia* sp., ♀, Patcham, Sussex, 24/5/36.

♀. *Erioischia (Hylemyia) brassicae* Bouché, ♂ (det. J.E.C.), Patcham, Sussex, 29/5/36.

♂. *Hylemyia variata* Fln., ♂ (det. J.E.C.), Shropshire, early October 1936, H. J. Burkill.

CORDYLURIDAE.

♂. *Scatophaga stercoraria* L., ♀, Beddington, Surrey, at sewage farm, 2/6/35.

CHLOROPIDAE.

♀. *Melanum (Capnoptera) lateralis* Hal., ♀ (det. R.L.C.), Bodmin, Cornwall, 18/8/36.

PREY OF SCATOPHAGA MACULIPES ZETT. (CORDYLURIDAE).

(1 ♂)

DIPT., EMPIDIDAE.

♂. *Hilara quadrivittata* Mg., ♂ (det. J.E.C.), Patcham, Sussex, 25/5/36.

NOTES.

Asilus crabroniformis L. The Grasshoppers were caught in the air while leaping. The flies were seen crouching on the grass tracks on the fixed dunes or towans, sometimes on short stumps of dead thistles, etc. From these places they made their " capture darts " and longer, prospecting flights. One individual, without prey, allowed me to touch it with the net, moving only a few inches each time it was touched before finally flying away. It may have been digesting a heavy meal for several others of the species were very wary. On the other hand it may have been " playing possum." The captor of the beetle dropped on to its side when the net was placed over it, still clasping the prey and remaining motionless, apparently dead, for several seconds before suddenly flying up, producing a loud buzzing sound.

Empis tessellata L., *E. livida* L., and *Pachymeria femorata* F. In some species of Empididae, the male captures prey and transfers it to the female during the act of mating. In these species, females never capture prey themselves, and so single insects observed with prey are always males.

Scatophaga stercoraria L. In the above list, only six examples with prey are recorded on 27th May 1936, but at least 20 others were noted with the same prey, *Dilophus femoratus*, which was particularly abundant on umbellifers in the hedgerows at this time. When hunting, the Dung-fly would crouch on a leaf with the tip of the abdomen almost touching it and the head held high; movement of prey was recognised at a distance of at least nine inches and the Dung-fly rotated itself, always facing the intended victim. Prey was caught by means of a "capture dart" of 1 to 2 inches.

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A NEW ICHNEUMONID (*SCOPIMENUS PYGOBARBUS*) PARASITIC ON *NEMATUS PROXIMUS* LEP. (HYM., TENTHREDINIDAE) IN BRITAIN.

BY MARY CARLETON, PH.D. (BRISTOL).

WITH A DESCRIPTION OF THE ADULT BY DR. A. ROMAN (STOCKHOLM).

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiii.

While rearing large numbers of the bean-gall sawfly of willows (*Nematus proximus* Lep.), half a dozen females of a new species of Ichneumonid emerged. It has been named *Scopimenus pygobarbus* by Dr. Roman, of Stockholm, whose description of the adult is given in the second part of this paper.

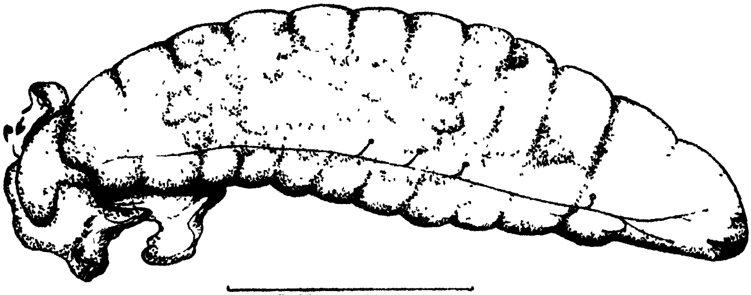
The method of breeding was as follows. Galled leaves of *Salix triandra* L. containing full-grown sawfly larvae were collected and placed in thin layers over fine moist soil in trays. The majority of the larvae left the galls and spun cocoons in the soil, the remainder spinning within the galls. The cocoons were collected and placed in glazed earthenware pots with a small quantity of fine soil. The pots were covered with muslin tied down firmly to prevent the escape of any emerging insects, and kept out of doors.

As soon as emergence started, the imagines were collected and examined each day. On August 20th, 1934, two female *S. pygobarbus* emerged from *N. proximus* summer cocoons. In 1935, *S. pygobarbus* emerged on June 29th, July 2nd and 9th from *N. proximus* winter cocoons, and on August 20th and 26th from *N. proximus* summer cocoons. In all cases the emergence of the parasite coincided with that of unattacked specimens of its host.

Since another Ichneumonid, *Angitia vestigialis* Ratz., also

appeared at the same time and was extremely common, it was impossible to trace the actual cocoons from which the *S. pygobarbus* had emerged. Nothing definite is known of the early stages, the parasite being so rare that the chances of finding it by dissection of even large numbers of sawfly cocoons are extremely small. In the spring of 1935, 5,136 sawfly cocoons were under observation. The imagines which emerged from them were 1,394 *N. proximus*, 153 *A. vestigialis*, and 3 *S. pygobarbus*.

It is worth noting that eleven ectoparasitic larvae were found feeding on the sawfly prepupae during the routine dissection of 1,950 *N. proximus* cocoons during the winter 1934-35, but none was ever reared to maturity. It is possible that these were the larvae of *S. pygobarbus*, for the only other parasite emerging from the cocoons was the endoparasite *A. vestigialis*, which could be recognised with certainty at every stage of its life-history. The evidence is not by any means conclusive, for about twenty species of parasites have been recorded from *N. proximus*, but of these only nine were bred during the present investigation. It is, therefore, possible that the ectoparasitic larva mentioned above was not of the new species.



Larva of *Scopimenus pygobarbus* Rom. (?).

The larva was always found firmly attached to the skin of the host prepupa by the shrivelled remains of its cast skins. It was almost impossible to detach the larva without injury to its small hooked caudal appendage, so firmly was it held by the exuviae.

The larva figured is probably in its second instar, since only one cast skin is present. The cuticle is roughened on the thorax and abdomen with many minute bosses bearing fine apical spines, which become smaller and fewer towards the posterior end of the body. The cuticle of the head bears a few very fine microtrichia. The antennae are a pair of minute unsegmented papillae. The

mouth-parts are at the bottom of a slight buccal depression, which serves as a suctorial organ. The mandibles are about 0.06 mm. in length, sharply pointed, falcate and well pigmented. The body contents are pale yellowish-brown, and the abdomen contains large masses of fat, which appear opaquely white through the body wall and obscure the gut completely in this region. The caudal appendage is short and stout and curved ventrally into a hook. In life it is entirely concealed by the cast skin of the first instar. There is a pair of large circular spiracles on the prothorax and on the first three abdominal segments.

The larva seemed to be unable to survive the opening of the host cocoon. Within a day or so of dissection, the parasite died, though no mechanical injury had been made. 'Dissection' generally consisted only in cutting a small window in the side of the cocoon, though sometimes it was necessary to remove the sawfly prepupa from it entirely before the parasite could be seen. In these instances, the host and parasite were afterwards returned to the cocoon, manipulation being as gentle as possible. They were then placed in small glass tubes, lined with moist cotton wool and tightly corked to prevent loss of humidity. In spite of these precautions not one larva was successfully reared.

Dr. Roman has kindly sent his description of the adult for publication in England.

Long Ashton Research Station,
Bristol.
December, 1936.

Description of a new genus and species of Ichneumonidae.

By A. Roman.

Two specimens of an Ichneumonid reared from the Nematine sawfly *Pontania proxima* Lep. (=*capreae* L. according to Enslin) by Miss M. Carleton, Long Ashton, Bristol, were recently sent to me for identification. The sex was difficult to decide, and as there were three more specimens I asked to see them, in the hope of discovering the other sex. All five, however, were found after some inspection to be females, though at first looking more like males. The species is a Tryphonine of the section *Homalopi* belonging to the sub-tribe *Polyblastina*, but cannot be referred exactly to any of the existing European genera, so a new one has to be erected.

Genus **Scopimenus**, nov.

Inter *Scopiorum* Foerst. and *Erromenum* Holmg. collocandum, ab illo abdomine magis parallelo tergitis basalibus non transversim impressis, ab hoc

terebra ipsa sensim decurva et acuminata femoribusque gracilibus (III apice tibiae parum crassioribus), ab ambobus hypopygio subtus medio pubescentia densa sat longa, basin versus reclinata, vestito, discedens.

This genus is intermediate between *Scopiorus* and *Erromenus*; it has the downwardly curved terebra with the uncompressed sheath and the rather slender femora found in the first, and the sub-parallel abdomen without transverse impressions on the basal tergites as in the second. The broadly red anal end of the abdomen occurs in *Erromenus* but not in *Scopiorus*, the dense reclined hair-tuft on the hypopygium is a feature unknown in either genus. The type and two more females are in the British Museum (Natural History), and two females in the Naturhistoriska Riksmuseum, Stockholm.

S. pygobarbus sp.n.—2 ♀♀, die 20. Augusti, 1934, exclusae.

♀. Nigra, clypeo, pictura superne 4-cuspidata faciei (in typo parum distincta), genis, palpis, mandibulis praeter apices, limbo laterali tergitorum 2. & 3. anguste, ventre, trochanteribus omnibus, coxis I totis, II & III—his basi postice ± fuscis—apice calcaribusque, stramineis, antennis subtus, femoribus et tibiis omnibus—his III apice infuscatis—tarsis I & II abdominisque tergiti 2. limbo apicali anguste, 3^i late cum tergitis reliquis totis, rufis, tarsis III infuscatis. Alae hyalinae nervis et stigmate fuscis, hoc basi cum radice, tegula punctoque ante-alari, albidis. Long. 5, ala ant. 4 mm.

Corpus nitidum. *Caput* thorace sublatius politum, pone oculos rotundatum vix angustatum, occipite pone ocellos angulatim emarginato, fronte transversim plana, pone singulam antennam basi impressa, facie tenuiter pubescente, epistomate subtumido, clypei bene discreti foveis basalibus parvis nudis, margine apicali rotundata, genis basi mandibulari brevioribus, costa genali inflexa, orali non elevata. Antennae corpore breviores in medio subincrassatae, flagello (21-) 22-articulato, articulo 1. 2° vix, latitudine sua apicali fere 4-plo longiore, articulis omnibus ± elongatis. *Thorax* subcompressus latitudine vix $1\frac{3}{8}\times$ longior nitidus, pronoti epomiis tenuibus rectis, mesonoti notaulis haud profundis trientem attingentibus, scutello modice elevato lateribus immarginatis, epicnemiis utrinque sulcum pronoti attingentibus, mesopleuris politis inferne parce punctulatis, pectore valde transverso mesolco postice breviter occluso; segm. medianum longitudine altius areis basali parallela & centrali postice dilatata confluentibus, hac costulam pone medium emittente, area postica plana 6-angulari haud v. vix transversa. *Abdomen* nitidum capite + thorace vix dimidio longius hujus latitudine, segmento 1. apicem versus sensim dilatato, latitudine apicali vix duplo longiore, glymmis, fovea basali & carinis dorsalibus fere ultra medium postpetioli extensis instructo, spiraculis vix ante medium sitis, segmentis 2. & 3. vix transversis impressione nulla transversa, illo spiraculis in triente anteriore marginis sitis, thyridiis rotundatis translucentibus parum impressis, hoc (3.) parallelo fere a basi polito, segmentis reliquis brevibus, sternitis 1.-3. plica media sat alte elevata, 6° (hypopygio) praecedente longiore apicem attingente, margine apicali late rotundato medio subproducto, subtus in medio pubescentia densa longiuscula pallida basin versus reclinata vestita, terebrae spiculis a basi sensim acuminatis, decurvis, valvulis late depressis, breviter exsertis forcipem maris illudentibus, circa marginem pilis sat longis fulvis instructo. *Pedes* sat graciles longitudine

mediocri, III femoribus latitudine c. 4½ × longioribus, tibiis rectis postice prope basin callo instructis, calcare interno latitudinem apicalem tibiae circ. aequante, trientem metatarsi vix superante, hoc articulis 2.—4. unitis sublongiore, ungue articulo 2. aequali, unguiculis longius pectinatis. *Alae* abdomen vix superantes, stigmate radium vix fractum e medio emittente, cellula radiali brevi, parte ejus costali stigmate parum longiore, areola nulla, nervo areolari breviore quam a nervo recurrente distante, hoc recto, fenestra supra (ante) medium sita puncto corneo diviso, angulo infero (postico) ± acuto, nervo parallelo infero, nervulo obliquo nonnihil postfurcali; posticae nervello fortius antefurcali longe inferne fracto, hamulis 4—5.

This remarkable species is easily recognised by the abdominal coloration combined with the hair-tuft on the hypopygium. The broadly transverse sheath of the terebra resembles an exaggerated *Scopiorus* sheath, and at first reminds one more of a male forceps, to which impression the pubescence of the hypopygium, in many Aculeates a male feature, adds considerably.

Stockholm.
December, 1936.

14

[*Reprinted from the 'Journal of the Society for British Entomology,' Vol. I, Part 7. Date of publication, 14th June, 1937.*]

A

A note on some parasites of Zygaena (Lep.).

A colony of *Zygaena* occupying a considerable area on top of the cliffs at Mawgan Porth, North Cornwall, provided some interest during a visit to the Bedruthan Steps Hotel from the 2nd to 19th August, 1933. Part of the colony was on the edge of the cliff in front of the hotel, and another part on the cliff across the inlet. At the time of the visit the greater number of the moths had emerged, but some were still coming out: all seen and bred were *Z. filipendulae* L. A very few cocoons were distinguishable by the yellow skin of the pupa protruding through the end, which offered a striking contrast to the normal black skin of *filipendulae*. My wife assisted in collecting as many cocoons as we could, some of which appeared to be relics of the previous summer. An attempt is made in this note to distinguish between cocoons which seemed to have been torn open by some predator (possibly earwigs, which were often found inside old cocoons, though they may only have been sheltering); those apparently bitten into by ants, which have a stained and minutely irregular margin to the hole, suggesting that body fluids have exuded from the pupa, and the small, clean hole left by emergence of a Hymenopterous parasite. But there is in the Hope Department a Zygaenid cocoon showing a similar irregular opening with the edges not stained. Dr. B. M. Hobby, who found this at Christchurch, Hants, August, 1927, saw a Pentatomid larva actually sucking the pupa, so that it is possible that a small, irregular hole may be due to various agents. A 'torn'

cocoon is of course not to be confused with one showing the normal exit hole at the upper extremity; the 'tear' may be no larger than would have been left by the emergence of a Tachinid parasite, or it may be large and irregular so that more than half of the cocoon has been damaged or removed. The following are the groups to which the cocoons, of whatever age, were assigned:

1.	Intact, with apparently living pupae (exclusive of group 6c)	76
2A.	Normal emergence, with pupal skin *in situ*, including 1 also 'torn'	222
B.	Ditto, but skin missing, including 21 also 'torn'	395
3.	Pupa dead inside cocoon	24
4.	Cocoon 'torn,' no remains of pupa	157
5.	Pupa apparently destroyed by ants (stained edge to irregular hole)	35
6A.	Pupa apparently destroyed by Hymenopterous parasite (small clean hole)	9
B.	As A, but cocoon also 'torn'	4
C.	Cocoons from which parasites were reared ...	23
D.	Cocoons with parasitic cocoons on the exterior	3
7A.	Pupa Tachinised (cocoon either contained Tachinid pupae or showed exit of Tachinid)	5
B.	Cocoon showing exit hole of Tachinid, but also apparently bitten by ants	1
	Total cocoons examined	954

Out of the total of 954 examined, 617 apparently produced imagines, and 76 contained apparently healthy living pupae: 261 for one reason or another failed to produce imagines. The parasites that emerged from these cocoons between 15th August and 5th September were identified by Messrs. J. E. Collin and J. F. Perkins, to whom the writer is greatly obliged. The specimens are at Oxford, in the Hope Department of Entomology of the University Museum, except for representatives given to the National Collection.

DIPTERA. TACHINIDAE.

Tachina larvarum. Linn. 1.

HYMENOPTERA. ICHNEUMONIDAE.

Gambrus ornatulus Thoms. 2 ♂♂, 9 ♀♀.

On this species Mr. Perkins kindly reported: 'There is no material of *G. ornatulus* in the British Museum and the species has not previously been recorded from Britain. Morley, however, refers to a species " ? *ornatus* Grav." that was bred from *Zygaena*, and very probably was this species: it is extremely close to *G. ornatus* Grav.'

Spilocryptus abbreviatus F. 2 ♀♀. Typical form.
This is not mentioned by C. Morley and W. Rait-Smith (1933, *Trans. R. ent. Soc. Lond.*, **81**: 138) in the list of parasites of *Zygaena*.

Apanteles sp., hyperparasitised by an undetermined species of *Gelis*. 4 ♂♂, 7 ♀♀ from one host larva.

It will be of interest to add here a note from Mr. Perkins on parasites from *Zygaena lonicerae* Esp. and *filipendulae* from various British localities reared by Mr. H. R. Hewer in 1929-30. 'From Hewer I only got *Mesostenus subovalis* Thoms. and *Casinaria orbitalis* Grav. as primary parasites and a batch of hatched cocoons of *Apanteles zygaenarum* Marsh., *Gelis* sp., a hyper-parasite of *Casinaria*, and *Mesochorus* sp. which may possibly be a hyperparasite of one of the Tachinids. But among your batch I found none of that species.' Mr. Hewer bred also two species of Tachinids, *Phryxe nemea* Mg. and *Eutachina fasciata* Fall. (det. D. Aubertin, 1933).

The second part of this note concerns specimens, also at Oxford, from Wood Fidley, New Forest, bred and presented in 1913 by the late F. C. Woodforde, with the following remarks: 'Three larvae seen circa July 15th emerging from the body of a *Zygaena meliloti* Esp. killed with ammonia on circa July 12th. They pupated in sand and flies emerged between August 4th and 19th.'

Dr. F. W. Edwards very kindly identified the flies as the Phorid *Megacelia* (*Aphiochaeta*) *rufipes* Mg., 2 ♂♂, 1 ♀. The presence of a Dipterous larva in the imago of a *Zygaena* was recorded by H. M. Edelsten (1934, *Proc. R. ent. Soc. Lond.*, **8**: 131), the specimen being a *Phryxe vulgaris* Fall. ♀, and the moth *Zygaena lonicerae* in Wood Walton Fen, Cambridgeshire.

G. D. Hale Carpenter
(*Hope Professor of Zoology* (*Entomology*) *in the University of Oxford*).

B

Escape of Butterfly after capture by Bird.

On 16th July, 1936, at Wolvercote, Oxon., a hedge sparrow was seen holding in its beak a living meadow brown (*Maniola jurtina* L.), which it was endeavouring to feed to a young cuckoo, slightly larger than itself. The butterfly, however, succeeded in breaking free before the cuckoo could seize it, and fell to the grass, whence it flew away after a few seconds.

J. Ford.

C

Anthicidae (Col.) new to Berks and Oxon.

Three examples of *Anthicus bifasciatus* Ross. were collected in haystack-refuse on 3rd November, 1935, on the Berkshire bank of the Thames at Godstow. This appears to be the first

Berkshire record for the species, which was previously found in the Oxford district by Mr. J. Collins at Water Eaton, and later by Commander J. J. Walker at Summertown (1936, *Rep. Ashmol. nat. Hist. Soc.*, **1935**: 15-16). A single specimen was again taken in a manure-heap near Waterperry, Oxfordshire, on 6th June, 1936.

Anthicus tobias Marsh., which was recently added to the British list, was found for the first time in Oxfordshire at Watlington, on a small ash-dump, on 20th June, 1936. Two specimens only were captured, after a lengthy search, under stones and pieces of tin lying about on the surface of the dump. Guichard (1936, *Ent. mon. Mag.*, **72**: 40) gives a resumé of the previous occurrences of *A. tobias* in England.

E. W. AUBROOK.

D

Emergence of the parasitic Ichneumonid Orthopelma luteator Grav. from the gall of Rhodites rosae (L.).

The Cynipid gall, sent me by Miss C. K. Pearce, was found in 1935 on rose by Sidney Taylor in the garden of Churchen Green School, E. Morden, Wareham, Dorset. Many insects had already emerged and the following were recorded by me in 1936:—

May 15	-	1	*Orthopelma luteator*,	♀.	
,, 17	-	1	,, ,,	♀.	The date is approximate.
,, 21	-	3	,, ,,	2 ♀, 1 ♂.	
,, 23-4	-	2	,, ,,	2 ♀;	also 1 *Rhodites rosae*, ♀.
,, 26	-	1	,, ,,	♀.	
,, 27	-	1	,, ,,	♀.	
,, 29	-	1	,, ,,	♀.	
June 3	-	1	,, ,,	♀.	
,, 5	-	1	,, ,,	♀.	
,, 9	-	1	,, ,,	♀.	
,, 14	-	1	,, ,,	♀.	
			Total ...	13 ♀, 1 ♂	

Mr. J. F. Perkins, in kindly naming the specimen which emerged on 15th May, wrote: 'This parasite is frequently bred in greater numbers than the *Rhodites* from these galls'—a conclusion which is strongly confirmed by the above record of 13 females and 1 male of the Ichneumonid to a single female of the Cynipid. The parasite is placed by Morley in the Ichneumonidae-Cryptinae-Hemitilini. The perforations on the surface of the gall indicate 31 emergences—more than double the number in the above list. I have also to thank Mr. R. B. Benson and Dr. B. M. Hobby for kind help in preparing this brief record.

E. B. POULTON.

E

Bees and Conopidae (Dipt.).

Two interesting series of bees (*Halictus*) taken with their Dipterous (Conopid) mimics at Hunstanton, Norfolk, in September, 1900, and at Bembridge, Isle of Wight, in August, 1901, respectively, were mislaid, and when recently recovered, the name of the captor and donor could not be determined with certainty.* We felt confident, however, that the handwriting was that of an old friend Edward Saunders, an opinion confirmed by Dr. R. C. L. Perkins and finally settled by Mrs. M. A. Saunders, who kindly sent the diary which records the visit to Hunstanton, September 25th to October 2nd, 1900.

The specimens comprise a male and a female *Halictus morio* F. and two female *Oncomyia pusilla* Mg. on one mount, labelled in the MS. of Edward Saunders 'Hunstanton / same bank / Fly very similar / to Halictus in movement / 9.00.'

A second label in Saunders' MS. reads 'Halictus / nidiusculus ♂ ♀ / with Conops?', but this has certainly been misplaced as well as mis-spelt and should evidently refer to the two *H. nitidiusculus* mentioned below.

All the specimens from the Isle of Wight are mounted separately and labelled in Saunders' MS. 'Bemb./I.W./8.01.' They consist of a male *H. morio*, a male and a female *H. nitidiusculus* Kirb., three female *Oncomyia atra* F., and one male and one female *O. pusilla* Mg. The single example of *H. morio* bears a second label in Saunders' MS., 'H. morio/with Conops.'

We are much indebted to Mr. R. B. Benson and to Dr. F. W. Edwards for kindly confirming the identifications given above.

Dr. R. C. L. Perkins wrote (*in litt.*, 15.v.1935): 'Both *Oncomyia pusilla* Mg., and the one other very similar, but larger, species of the genus, *O. atra* F., I have collected and seen in many cases in connection with species of *Halictus*. The Conopids of the genus *Myopa* which are parasitic on *Andrena* I have seen follow a laden *Andrena* right to the burrow on various occasions, but the Andrenas are then provisioning their nest, which may already contain eggs or the pollen or larvae. The Oncomyias which are most common in autumn, when the Halicti are numerous, are in a different situation, since these Halicti are not then provisioning their nests, but the females are (after pairing) about to hibernate—the males dying before winter. The Oncomyias do not themselves hibernate, so that if really parasitic on *Halictus* I suppose they must pass the winter as eggs or first instar larvae. My idea in collecting a few specimens with the Halicti was that the forms of *Oncomyia* on different hosts might form distinct races or subspecies.'

B. M. Hobby & E. B. Poulton.

* Specimens in the Hope Department, Oxford University Museum.

Notes on the larvae and pupation of the Geometrid Moth *Phorodesma smaragdaria* F. (Lep.).

My kind friend Mr. Hugh Main, who has so often given me great pleasure by sending rare and interesting insects for study, wrote on 12th May, 1936, the following letter accompanying the hibernated larvae of *Phorodesma smaragdaria* which are the subject of these brief notes:—

'I found the larvae of the "Essex Emerald" last autumn in the Essex marshes, and they hibernated and recently started to feed again. They were on *Artemisia maritima*, which is abundant all along the banks of the various rivers on the Essex coast. I had put into the garden some plants of the garden *A. abrostanum* for them, but I found some time ago that they would eat *A. vulgaris*. The leaves of this species are, however, not so suitable for providing "coats." South also gives *A. absinthium*. I enclose a couple of sprays of *maritima* that should carry you over till you get another supply. The larvae spin up nicely among the leaves and stems of the *Artemisia*. The food-plant is apt to dry up rather readily unless kept in cages with a *slightly* damp atmosphere.'

Mr. Main also directed my attention to the papers on this species by the Rev. C. R. N. Burrows (1900, *Ent. Rec.*, **12**: 113-5, 152-4, 169-71 (Pl. VII), 171-2), who himself refers to the paper by G. Elisha (1886, *Trans. Ent. Soc. Lond.*, **188**: 465-8).

The supply of *A. maritima* L., which arrived with the larvae, lasted well in glass, white-muslin-topped, cylinders resting on plates drilled for the stalks to pass through into water beneath. The following species of *Artemisia* are mentioned by Mr. Hugh Main as among the plants eaten by these caterpillars: *abrostanum* L. (Southern Wood, Old Man), *absinthium* L. (Wormwood), *vulgaris* L. (Mugwort), and in addition *Tanacetum vulgare* L. (Tansy) has been found acceptable. My larvae, however, did not appear to thrive on these species after their earlier stages on *A. maritima*, and when a second supply of this plant, kindly sent by Mr. Main, was nearly exhausted, I began to feel anxious until Mrs. Moullin, the Secretary of Oxford University Botanical Dept., kindly sent an ample amount of *A. mutellina*, which is growing in the Botanic Gardens. The result was so satisfactory that I think entomologists will be glad to know more about this food-plant. Prof. A. G. Tansley, F.R.S., has kindly written the following account of it:—

'12th June, 1936—*Artemisia mutellina* Villars is apparently properly called *Artemisia laxa* (Lamarck) Fritsch. It is an alpine plant, known to the German-speaking people as "Edelraute," and is said to be so much prized and sought after that it has become rare in many parts of the Alps, especially in the Austrian Mountains. It is used as a tonic, febrifuge, etc., and also

decoratively.'

The wonderfully procryptic effect of the fragments of food-plant attached to the larvae gave very great pleasure to me and to the many friends who saw the caterpillars, and I thought that a careful study of the mode of attachment, investigated with the help of modern instruments, would be extremely interesting. I therefore asked my friend Dr. B. M. Hobby if he would undertake this work. He consented and has written the illustrated statement which follows these notes upon the four larvae and especially upon the behaviour of two of them prior to pupation.

Larva 1 appeared to be mature on June 9th and was taken to the Hope Dept. for Dr. Hobby to study. It was brought back on the same day and in about twenty-four hours had spun a cocoon on the muslin cover. On June 15th, about 10.0 a.m., I observed that the larva had bitten a hole in the cocoon and that about half its length was hanging free. A little later it had fallen a distance about 4 ins. on to the plate and at about noon I carried it to the Dept. for Dr. Hobby to draw. When, however, he arrived on June 16th to finish the work, pupation had occurred and the chrysalis had already darkened to the permanent shade of brown. A male emerged June 28th-29th.

Larva 2 began to spin on June 12th and, unlike any of the others, gnawed a hole in the muslin cover. When this was taken off and replaced the disturbed larva returned to the hole in a few minutes and again gnawed the muslin. Although feeding had ceased the larva continued to pass faeces from time to time, three being removed about 5.30 p.m., one later the same evening, two on the morning of June 13th and one (the last) at 4.15 p.m. On the morning of June 13th the larva had abandoned the hole and was apparently spinning at another part of the muslin. On June 14th it was certainly spinning at the same spot as on the day before. On June 16th the cocoon was taken to the Dept., cut open about 3.15 p.m., and the larva removed in order to be studied and drawn. At 3.30 p.m. on June 17th it pupated while Dr. Hobby was at work on the drawing. A female emerged June 28th-29th.

Larva 3 pupated June 11th-12th, the chrysalis being exposed and free from any covering. A female emerged on June 25th.

Larva 4 also produced an exposed pupa June 11th-12th. A male emerged on June 26th.

The behaviour of the larvae suggests a possible transition from pupation in a cocoon attached to the food-plant to a final ecdysis on the ground where the pupa would be hidden among vegetable débris. It must be remembered that the larvae were healthy and produced normal moths, two of each sex.

E. B. POULTON.

Notes on the larva of Phorodesma smaragdaria F. (Lep.).

The description of the larva of *Phorodesma smaragdaria* given by Burrows (1900, *Ent. Rec.*, **12**: 169-70, Pl. VII) is very complete and there is little to be added. The larva is of the usual Geometrid type, but has a rough skin, a pattern of longitudinal stripes and well-developed setae; the large dark spiracles are arranged along a sigmoid curve (Fig. 14: 1). Fragments of the food-plant are attached to special tubercles found on the 1st, 2nd, 3rd, 4th, 5th and 8th abdominal segments by means

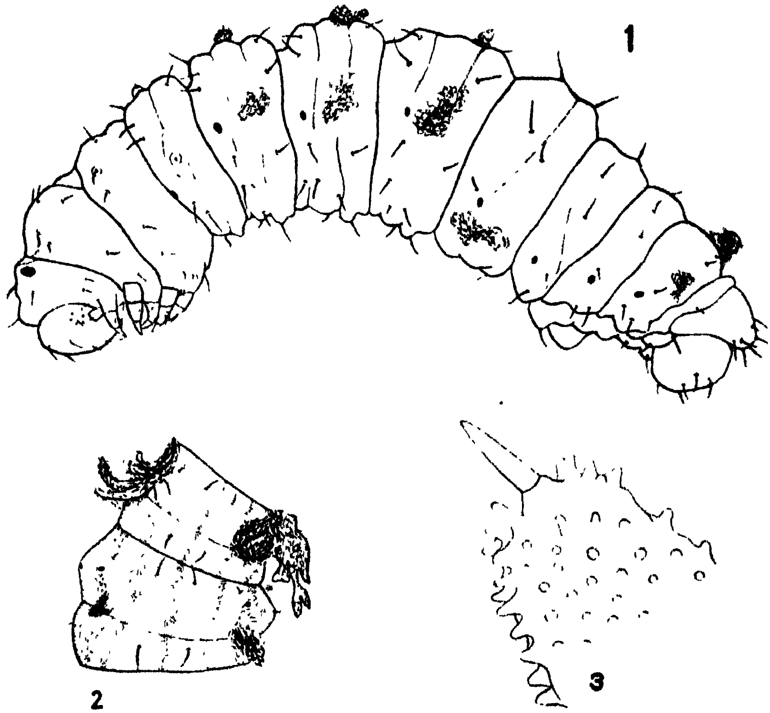


FIG. 14. 1.—*Phorodesma smaragdaria* F. Lateral view of larva, showing special tubercles of 1st, 2nd, 3rd, 4th, 5th and 8th abdominal segments, all except the first covered with silk. 2.—Dorsal view of larva, showing 2nd and 3rd abdominal segments with special tubercles covered with silk and fragments of the foodplant. 3.—Lateral view of special tubercle.

of silken threads spun by the larva (Fig. 14: 2). Each tubercle (Fig. 14: 3) is a conical fleshy process with a stout terminal spine and numerous small projections all over the surface. All are subdorsal in position except that of the 5th abdominal segment, which is placed low down at the side of the segment below and behind the spiracle. The tubercles are admirably adapted to

give a firm hold to the silken fibres and usually retain them even when the larva is deprived of its covering of leafy fragments.

B. M. Hobby.

H

Parasitic Hymenoptera bred from British Lepidoptera-Heterocera by H. C. Hayward, M.A., F.R.E.S.

The following list of parasites of British moths should be compared with Mr. Hayward's earlier breeding records published (1933, *J. Ent. Soc. S. Engl.*, **1** (3): 53-55) by Sir Edward Poulton, to whom I am indebted for the privilege of studying the material. As in the account of Mr. Hayward's previous observations, the names of the hosts, localities, the stage of the host (whether larva or pupa) from which the parasite emerged, with the month and year of emergence are usually given. For determination of the parasites I am indebted to Dr. C. Ferrière and Mr. F. J. Perkins, these authorities being indicated in the table by the bracketed initials of their surnames.

In view of our scanty knowledge concerning the parasites of even the commonest species, it is to be hoped that Lepidopterists and others will carefully preserve and label all specimens they may have the good fortune to breed and take suitable steps to have their observations properly recorded. I may add that all the above-mentioned material is incorporated in the bionomic collections of the Hope Department of Entomology, Oxford University Museum, and that the gift of further specimens would be very much appreciated.

Parasite.	Host and stage (when recorded).	Locality and date of emergence (when recorded).
BRACONIDAE. MACROCENTRINAE.	LEPIDOPTERA.	
Macrocentrus abdominator F., 3 ♀♀ (P.).	*Cacoecia podana* Scop., larva (TORTRICIDAE).	? Locality: vi.1933.
ICHNEUMONIDAE.		
(*a*) CRYPTINAE.		
Hemiteles bicolorinus Gr., 1 ♀ (P.).	?*Borkhausenia fuscescens* Haw. (OECOPHORIDAE).	? Locality: vii.1933.
Hemiteles sp., 1 ♀ (P.).	?*Peronea hastiana* L. or *P. logiana* Schiff. (TORTRICIDAE).	S. Dorset: ix.1933.
(*b*) ICHNEUMONINAE.		
Platylabus pedatorius F. var. *iridipennis* Wesm., 4 ♂♂ (F.).	*Eupithecia albipunctata* F., pupa (HYDRIOMENIDAE).	Repton, Derbyshire: iii.1933.
do., 15 ♂♂, 8 ♀♀ (F.).	do.	do.: iv.1933.
do., 2 ♂♂, 1 ♀ (F.).	do.	do.: v.1933.
Platylabus pedatorius F. var. with red abdomen, 1 ♂ (F.).	do.	do.: v.1933.

PARASITE.	HOST AND STAGE (WHEN RECORDED).	LOCALITY AND DATE OF EMERGENCE (WHEN RECORDED).
(*c*) OPHIONINAE.		
Angitia sp., 1 ♂ (F.).	*Peronea hastiana* L., larva (TORTRICIDAE).	Swanage: ix.1933.
do., 1 ♂ (F.).	do.	S. Dorset: viii.1933.
do., 1 ♀ (F.).	*Fumea casta* Pall. (PSYCHIDAE).	Hants: vi.1933.
Blaptocampus nigricornis Wesm., 1 ♀ (P.).	*Hydriomena nigrofasciaria* Göze, pupa (HYDRIOMENIDAE).	Kent: 1933.
Omorgus mutabitilis Hlg., 1 ♂, 2 ♀♀ (F.).	*Endothenia gentianana* Hübn., larva (EUCOSMIDAE).	S. Dorset: iv.1933.†
Trichomma minuta Brm., 1 ♀.	*Peronea hastiana* L., pupa (TORTRICIDAE).	Studland, Dorset: 8.x.1933.
do., 2 ♂♂ (P.).	do.	do.: x.1933
(*d*) PIMPLINAE.		
Glypta sp., 1 ♂ (F.).	?*Eucosma cana* Haw. (EUCOSMIDAE). or *Phalonia badiana* Haw. (PHALONIADAE).	Kent: vii.1933.*
Itoplectis sp.? *alternans* Gr., 1 ♂ (P.).	*Peronea logiana* Schiff. pupa (TORTRICIDAE).	S. Dorset: ix.1933.
Phytodictus sp., 1 ♂ (P.).	*Peronea hastiana* L., larva (TORTRICIDAE).	Swanage, Dorset: ix.1933.
do., 2 ♀♀, 1 sex indet. (P.).	do.	Studland, Dorset: x.1933.
(*e*) TRYPHONINAE.		
Exochus sp.? *tibialis* Holmgr., 1 ♂.	do.	E. Dorset: 3.x.1933.
do., 1 ♂.	do.	do.: 9.ix.1933.
do., 1 ♂ (P.).	do.	Swanage: 9.ix.1933.
Tricistus curvator (F.) Grav., 1 ♀ (F.).	*Eupithecia trisignaria* Herr.-Schäff., pupa (HYDRIOMENIDAE).	Derbyshire: 10.vii.1933.

* Bred from heads of burdock. † Bred from teasel.

B. M. HOBBY.

Andrena marginata Fabr. (= cetii Sehr.) (Hym.) in Oxfordshire.

A number of this local species were taken on *Scabiosa* on the downs at Watlington on the 18th Aug., 1936. The specimens show considerable variation in colour, some being almost wholly yellow, others with a marked amount of infuscation.

F. J. KILLINGTON.

Spiral segmentation in the immature stages of Hipocrita jacobaeae L. (Lep., Arctiidae).

Amongst a number of larvae of *Hipocrita jacobaeae* L. collected *en masse* at Cumnor Hill, near Oxford, by Prof. G. D. Hale Carpenter in July, 1936, and given to me to breed, was a single example exhibiting spiral segmentation.

The fourth and fifth abdominal segments are affected, as in the larva of the same species described by Cockayne (1929). Ventrally the larva is quite normal, the black bands of all segments being parallel, and prolegs being present on abdominal segments 3, 4, 5 and 6. Dorsally, the epidermis has the appearance of being strongly twisted. There is an oblique black band of normal width, formed of the left half of the fourth and the right half of the fifth bands. The spiral is complete; the right half of the fourth band narrows as it unites with the third, and the left half of the fifth similarly fuses with the sixth (Fig. 15C).

Pupation took place on 25th July; the pupa was of normal size and showed the same abnormality.

The abdominal segments of the pupa are displaced to the left of the longitudinal axis (Fig. 15A). The hind margin of the third abdominal segment is recurved shortly on the right of the mediodorsal line, and is at once terminated; thus a compound segment is formed by the fusion of the third segment with the right half of the fourth. There is a short, curved impression sinistrad to the mediodorsal line of this segment.

In a normal pupa the spiracles are in a straight line, but in the aberrant example here described the spiracles of the fifth and following segments are displaced ventrally and dorsally on the left and right respectively, so that curved lines are produced (Fig. 15B).

Figures of two pupae of the Arctiid moth *Apantesis nais* (Dru.) showing left- and right-handed spiral segmentation are given by Learned (1932), who discusses the cause and origin of segmental abnormality.

I wish to thank Prof. Carpenter for the opportunity of making this description.

References.

COCKAYNE, E. A. 1929. Spiral and other anomalous forms of segmentation. *Trans. ent. Soc. Lond.*, **1929**: 177-84.

——— 1934. Spiral and other anomalous forms of segmentation, with an account of three ventral spirals in one brood of *Hadena dissimilis* Km. *Trans. R. ent. Soc. Lond.*, **1934**: 165-72.

HAWKINS, C. N. 1933. Abnormal larvae of *Amathes (Orthosia) macilenta*, Hb. (Lep.). *Trans. R. ent. Soc. Lond.*, **81** . 223-29.

LEARNED, E. T. 1932. An occurrence of spiral segmentation in *Apantesis nais* (Lep., Arct.). *J.N.Y. ent. Soc.*, **40**: 167-80.

E. W. AUBROOK

(Dept. of Entomology, University Museum, Oxford).

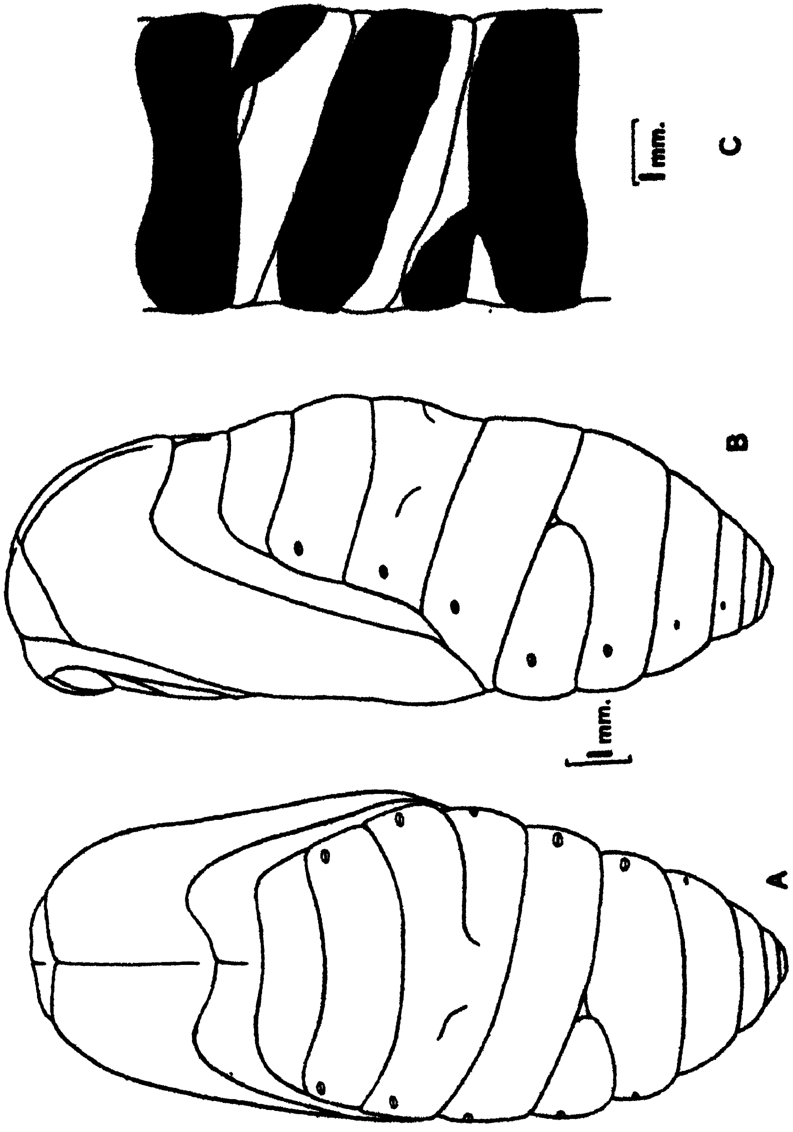


Fig. 15.—Spiral segmentation in *Hipocrita jacobaeae* L. A—pupa, dorsal view. B—pupa, lateral view. C—larva, third to sixth abdominal segments, dorsal view.

15

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Some records of bred Tachinidae (Diptera).

Dr. W. R. Thompson, in a comprehensive account of the Tachinid parasites of woodlice (1934, *Parasitology*, **26**: 378-448, pls. 15-22), recorded six species attacking *Porcellio scaber* Latr. My own attempts to rear some of these interesting parasites during the past two years have resulted in breeding two of them, viz. *Euplesina maculata* Fall. and *Melanophora roralis* L.

I am much indebted to Professor G. D. Hale Carpenter for permission to publish records of specimens in the University Collection, and to Mr. E. W. Aubrook for assistance in the collection of material.

Four colonies of woodlice obtained between December, 1935, and February, 1936, were kept in large tin boxes in the laboratory at the usual room temperature of 55° to 60° F. They were fed upon sliced potatoes and were occasionally sprinkled with water to maintain the necessary humidity. The material was examined daily, and all parasite pupae removed and placed separately in corked tubes. It was impossible to determine

which individuals were parasitised and which were not, until they died, when the puparium of the Tachinid showed clearly, entirely filling the body-cavity of the host.

The first parasite emerged on February 1st, 1936, others following at intervals until April 28th. The majority were *Melanophora roralis* L., but three *Euplesina maculata* Fall. were also bred. The pupation period of both species was about twenty-one days. Unfortunately the population density of the various colonies of woodlice was not estimated, and thus the percentage of parasitisation cannot be given. Thompson, however, states (p. 381) that 'the proportion of woodlice attacked by all the species taken together seldom exceeds five per cent. and is usually below that figure.'

Details of the material studied are given below :—

COLONY A. A pure population of *Porcellio scaber* Latr. from beneath the bark of a fallen elm at Water Eaton, Oxon, 8.xii. 1935, E. Taylor. Nine *M. roralis* bred.

COLONY B. A large colony of *P. scaber* from beneath elm bark at Marston, Oxon, 15.i.1936, E. W. Aubrook. Two *E. maculata* and thirty-three *M. roralis* bred.

COLONY C. A mixed colony of *Oniscus asellus* L. and *P. scaber* under elm bark at Barton, nr. Headington, Oxon, 9.ii. 1936, E. Taylor. Two *M. roralis* bred from *P. scaber*.

COLONY D. A small colony of *P. scaber* under bark at Tubney, Berks, 8.ii.1936, E. W. Aubrook. One *E. maculata* and two *M. roralis* bred.

An examination of the British Tachinidae in the Oxford University Museum resulted in the following records of species bred from known hosts. A small f. before a date indicates the date on which the parasitised host was collected; em. indicates the date of emergence.

Agria mamillata Pand. from *Hyponomeuta cognatella* Hübn. (Hyponomeutidae), Oxford, em. 12-26.v.1929.—A. H. Hamm.

Arrhinomyia cloacellae Kram. from larva of *Scardia boleti* Fabr. (Tineidae) in *Trametes gibbosa* Fr., Windsor Forest, Berks, em. 17.iii.1934.—H. St. J. K. Donisthorpe.

Brachycoma devia Fall. from nest of *Bombus hortorum* Linn. var. *harrisellus* Kirb. (Bombidae), Day's Lock, River Thames, Dorchester, Oxon, f. 14.vii.1911, em. 23-25.vii.1911.—A. H. Hamm.

Chaetolyga quadripustulata F. from pupa of *Cucullia verbasci* L. (Caradrinidae), Kennington, Berks, em. 17.vii.1936.—B. M. Hobby.

Compsilura concinnata Meig. from larva of *Nymphalis io* L. (Nymphalidae), Bournemouth, Hants, f. 3.vii.1917, em. 27.vii. 1917.—E. K. Pearce.

Id. from pupa of *Nonagria typhae* Thunb. (Caradrinidae), Tubney, Berks, em. Aug., 1929.—J. J. Walker.

Echinomyia grossa L. from pupa of *Eriogaster rubi* L. (Lasiocampidae), Longdown, New Forest, Hants, em. 3.vii. 1913.—F. C. Woodforde.

Ernestia rudis Fall. from *Polyploca ridens* F. (Polyplocidae), New Forest, Hants, em. 5-9.v.1913.—F. C. Woodforde.

Exorista hortulana Meig. from larva of *Acronycta alni* L. (Caradrinidae), Burnt Woods, Market Drayton, Staffs, f. viii. 1918, em. 14.vi.1919.—F. C. Woodforde.

Id. from larva of *Acronycta alni* L. (Caradrinidae), Brecknock Beacon, Brecknock, S. Wales, f. *c.* 4.ix.1920, em. 19.v. 1921.—O. Butler.

Id. from larva of *Acronycta psi* L. (Caradrinidae), St. Helens, I. of Wight, f. 25.viii.1925, em. 31.v.1926.—C. Poulton.

Exorista tritaeniata Rnd. from pupa of *Callophrys rubi* L. (Lycaenidae), nr. Stanton St. John, Oxon, f. vi.1918, em. 23.v. 1919.—J. Collins.

Miltogramma punctatum Meig. from burrow of *Colletes succincta* L. (Colletidae), Iona I., W. Scotland, f. 15.ix.1916, em. 23.vii.1917.—A. Gordon.

Nemorilla floralis Fall. from larva of *Nymphalis io* L. (Nymphalidae), St. Helens, I. of Wight, f. vi.1900, em. 20.vii.1900.—E. B. Poulton.

Parasetigena silvestris R.-D. from *Polyploca ridens* F. (Polyplocidae), New Forest, Hants, em. 5-9.v.1913.—F. C. Woodforde.

Phryxe vulgaris Fall. from larva of *Aglais urticae* L. (Nymphalidae), Cowley Marsh, Oxford, em. 27.ix.1897.—A. H. Hamm.

Id. from pupa of *A. urticae* L., Oxford, em. 7-9.vii.1898.—C. B. Sanders and E. B. Poulton.

Id. from larva of *Hadena meticulosa* L. (Caradrinidae), St. Helens, I. of Wight, f. *c.* viii.1925, em. *c.* 24.ix.1925.—J. A. Baldwin.

Ptychomyia selecta Meig. from 'evidently *Odynerus* nest in bolt hole, study door' (Vespidae), St. Helens, I. of Wight, em. 27.viii.1922.—E. B. Poulton.

Tachina larvarum L. from *Eriogaster rubi* L. (Lasiocampidae), Longdown, New Forest, Hants, em. vi.1913.—F. C. Woodforde.

Id. from larva of *E. rubi* L., nr. Falmouth, Cornwall, f. iv. 1936, em. 23.vi.1936.—G. D. H. Carpenter.

Tricholyga sorbillans Wied. from larva of *Saturnia pavonia* L. (Saturniidae), Chobham Common, Surrey, f. autumn, 1904, em. spring, 1905.—C. B. Sanders.

Id. from pupa of *S. pavonia* L., Haddon Hill, Somerset, f. 22.vii.1934, em. 1935.—E. S. Brown.

Ernest Taylor
(*Hope Dept. of Entomology, University Museum, Oxford*).

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxii.

TO THE MEMORY OF

FLORENCE JANE KIRK,

WHOSE PATIENCE, SKILL, AND UNFAILING ENERGY WERE AN INVALUABLE HELP IN ATTAINING THE RESULTS SET FORTH IN THESE PAGES.

'Thy forests, Windsor, and thy green retreats.'—JESSE.

'Where is June so joyous as within the courts and halls of peerless Windsor? Where does the summer sun shine so brightly as upon its stately gardens and broad terraces, its matchless parks, its silver belting river, and its circumference of proud and regal towers? Nowhere in the world. At all seasons, Windsor is magnificent; whether, in winter, she looks upon her garniture of woods stripped of their foliage, her river covered with ice, or, in autumn, gazes on the same scene, a world of golden-tinted leaves, brown meadows, or glowing corn-fields. But summer is her season of beauty—June is the month when her woods are fullest and greenest; when her groves are shadiest; her avenues most delicious; when her river sparkles like a diamond zone; when town and village, mansion and cot, church and tower, hill and vale, the distant capital itself—all within view—are seen to the highest advantage. At such a season, it is impossible to behold from afar the heights of Windsor, crowned, like the Phrygian goddess, by a castled diadem, and backed by lordly woods, and with-hold a burst of enthusiasm and delight.'—WILLIAM HARRISON AINSWORTH.

Although a certain number of records of the beetles collected in Windsor Forest and the surrounding district may be found in the works of Stephens, Fowler, and The Victoria County History of Berkshire, and also scattered through various Entomological publications, no attempt has been made up to the present time to classify, and to enumerate as a whole, the Coleoptera of this ancient forest land. The present list can, however, only be regarded as provisional; for although I have constantly investigated and collected in this beautiful Forest during the last fifteen years, and have also endeavoured to bring together the whole of the earlier records, there must still remain very many species to be discovered. The following list contains only such species as I have

taken myself, or are vouched for by published records. The total number of species is now 1,819, as against 147 already recorded from Windsor Forest. Of these I have retaken eighty-nine. This synopsis, however, professes to be more than a mere list of names, being written for others as well as for the systematic Coleopterist, to whom the species may be familiar. Thus it is obvious that many of the commoner beetles which destroy wood, etc., or are beneficial, are of more interest and importance to the public than any of our rarest species so dear to the collector. I have therefore added to these, and indeed to most of the species, a short account of the conditions under which they are found.

Although synonymy lies beyond the scope of this publication, I have taken the opportunity of correcting certain errors that have crept into the nomenclature of our British Coleoptera, as well as indicating the names by which the species referred to in the ancient records would be known to-day.* The classification adopted is that of the Catalogue of British Coleoptera by Prof. Sir T. Hudson Beare and myself, published in 1904, which does not differ greatly from that of the standard work on the Beetles of Britain by the late Canon W. W. Fowler.

Among the older entomologists who collected Coleoptera at Windsor in the early part of the last century the following names are prominent:—T. Desvignes, who captured many rare species; J. H. and J. R. Griesbach appear to have done a good deal of work in the Forest, the former being responsible for several very doubtful species; the Rev. F. W. Hope (the founder of the Hope Department in the University Museum at Oxford) evidently collected there, as did also the late E. W. Janson, to whom keys of the gates in the Forest were given, apparently, 'for services rendered.' The celebrated Dr. Leach and the late G. R. Waterhouse also explored the Coleopterous fauna of Windsor. The exact captures, so far as they are known, of all these pioneers of Entomology will be found in the body of this list.

I have endeavoured, at the British Museum (Natural History) (which contains the Stephensian collection of Coleoptera), as well as in the University Museum at Oxford, etc., to trace the actual specimens of the doubtful species (or at any rate such species as have not otherwise been recorded from Britain) included by Stephens (1828-1839) as from Windsor. The later pages of this paper will show that in many instances the search has been successful.

* The reason for this is that the numbers in that Catalogue form the index to the species in my Windsor Forest Pilot Files, and an immense amount of time would be lost in rearranging the whole list.

I may here mention the circumstances in which I came to investigate the Coleoptera of this most interesting locality. As the ant *Acanthomyops* (*Donisthorpea*) *brunneus* Latr. was not uncommon in Windsor Forest, where it inhabits many of the old trees, I determined to attempt the investigation of its life-history. This being accomplished successfully, and the inquiry having incidentally led to the discovery of many rare beetles, I thought it would be of scientific interest to make an intensive study of the Coleoptera of the locality. In this I have been greatly assisted and encouraged by the authorities of the Crown Estate Office, and I desire to take this opportunity of expressing my deep indebtedness to the late Mr. C. Lloyd, Deputy-Surveyor of Windsor Parks and Woods, and Chief of the Crown Estate Office, and to Mr. E. H. Savill, his successor, for all their unfailing kindness and courtesy, and the very valuable help that they, and all their assistants, have always rendered. But for this kind help the present paper could never have been written.

In the course of these investigations I have been fortunate enough to discover thirty-seven beetles new to Britain, including eight species new to science (to be mentioned in their proper places); three Diptera—*Pseudacteon brevicauda* Schmitz (a small fly found with ants), *Neophyllomyza fungicola* Hend. (also with ants), and *Calobata calceata* Fall. (the last-named being a very fine addition), new to Britain; one flea—*Ceratophyllus wickhami* Baker (parasitic on the Grey Squirrel), new to Britain; two aphids—*Stomaphis longirostris* F. (living with the ant *A.* (*D.*) *brunneus*), and a curious stalk-eyed species, new to Britain; some eight parasitic Hymenoptera, and two mites—*Antennophorus* n.sp., and *Laelapsis* n.sp. (Acari living with *A.* (*D.*) *brunneus*), new to science. I have also retaken certain Coleoptera recorded from Windsor nearly one hundred years ago. Some of these are:—*Agrilus sinuatus* Ol., *Elater nigerrimus* Lac., *E. coccinatus* Rye, *Ludius ferrugineus* L., *Ischnodes sanguinicollis* Pz., *Megapenthes tibialis* Lac., *Lymexylon navale* L., and *Scraptia fuscula* Müll.

Many species of beetles which are characteristic of the New Forest and of Sherwood Forest also occur in Windsor Forest. Such similarities are to be expected, inasmuch as all three localities are ancient forest lands. It is, however, interesting to note that several of the Windsor Forest species have only been found in one of the other two localities, as is illustrated by examples in the following list:—

	Windsor Forest.	New Forest.	Sherwood Forest.
Eucnemis capucina Ahr. - -	+	+	—
Teredus nididus Shuck. - -	+	—	+
Euplectus nubigena Reitt. - -	+	—	+
Cryptocephalus querceti Suffr. -	+	—	+
Quedius aetolicus Kr. - -	+	+	—
Lymexylon navale L. - -	+	+	—
Synchita juglandis F. - -	+	+	+
Rhizophagus oblongocollis Blatch.	+	—	+

The first five of these species and the last one have only been found in Britain in the localities marked + ; of the last three, *Lymexylon* has not been found elsewhere for many years, and *Synchita* is practically confined to the three localities.

Brief mention must be made of certain other insects with which beetles are associated.

The ant *A.* (*D.*) *brunneus*, already referred to, is rather common and inhabits many different kinds of trees. The other tree-ant, *Acanthomyops* (*Dendrolasius*) *fuliginosus*, a shining black species which marches in files, occurs at Swinley, Rapley, etc., but not in the same spots as *brunneus*.

The 'hill ant' *Formica rufa*, which may be found building its hillocks of pine-needles, etc., in Swinley Forest, etc., used formerly to occur nearer to Windsor, but has not been seen recently.

Both *Acanthomyops* (*Chthonolasius*) *umbratus* Nyl. and *A.* (*C.*) *mixtus* Nyl. occur, nesting at the foot of and in the wood mould of hollow trees; their curious Acarid guests, *Antennophorus uhlmanni* Hal., *Uropolyaspis hamuliferus* Mich., and *Sphaerolaelaps holothyroides* Leon., are usually present with them. We once found a mixed colony of *A.* (*C.*) *umbratus* and *A.* (*D.*) *brunneus*, showing that a ♀ *umbratus* had founded her colony in the *brunneus* nest; its usual hosts of course being *A.* (*D.*) *niger* L. and *A.* (*D.*) *alienus* Först.

Trees tunnelled by the larva of the Goat-moth (*Cossus cossus*) are present, but not nearly so commonly as in former years. Wasps are abundant, especially the species making nests in the ground, although those nesting in trees also occur; and one occasionally finds hornets' nests in old trees. The following observations on the hornets of Windsor Forest are perhaps not without interest. A colony had constructed its nest in a hole in the bough of an old oak, part of the comb being exposed, but flush with the surface. The nest and comb-material, or 'paper,' of this colony was not grey

like that of most hornets and wasps, but yellow, exactly matching the bare surface of the bough from which the bark had disappeared. Hence the comb escaped the eye, and was even difficult to detect when the position of the nest was known. It is possible that this resemblance was not accidental, but that the hornets, for constructing the paper-like fabric of the comb, had selected wood of a colour which matched the surroundings of the nest.

The woodmen at Windsor have informed me that young ash-stems are 'ringed' by hornets gnawing round them with their mandibles. We have since found such ringed stems. I think it is probable that the object of this habit is to obtain juice from the young bark as well as to provide the dead wood used in constructing the nest. A nest which I found in a hollow beech was guarded by a hornet posted like a sentinel at the entrance, a hole in the comb so small as to admit only one at a time. When a 'homing' hornet arrived, it settled on the nest and crawled up to this hole, the sentinel after due inspection withdrew and permitted the new-comer to pass, but immediately resumed its duties at the entrance. I was reminded of the behaviour of certain ants (species of *Colobopsis*, a subgenus of *Camponotus*) whose soldiers, having circular flattened heads exactly fitting the entrance-holes, actually provide the front-doors of the nest. This habit, which is known as phragmotic (*i.e.* closes the nest entrance with the anterior part of the head), is of course a more perfect arrangement than that of the hornet; for when the entrance is blocked by the ant's head it becomes invisible.

No special search has been made for butterflies and moths (this, of course, only refers to ourselves), but a number of the former have been noted. Of these one may mention — a single specimen of the Camberwell Beauty (*Nymphalis antiopa*) was seen flying across a Sphagnum swamp (9.viii.32); this, however, was probably an individual that had been liberated. The Purple Emperor (*Apatura iris*) may be sometimes observed flying over the tops of high oaks. The White Admiral (*Limenitis camilla*) occurs in several localities, and the Red Admiral (*Vanessa atalanta*), Peacock (*Nymphalis io*), Painted Lady (*Vanessa cardui*) and Small Tortoiseshell (*Aglais urticae*) are generally common and sometimes abundant. The Brimstone (*Gonepteryx rhamni*) is not uncommon on the wing early in the year.

Of the Fritillaries, the Pearl Bordered (*Argynnis euphrosyne*), the Silver Washed (*A. paphia*), the High Brown (*A. adippe*), and the Dark Green (*A. aglaia*) are not uncommon at bramble blossoms,

etc. A form of the Grayling (*Eumenis semele*) which we have taken in Windsor Forest is possibly a local race.

The following additional species have been taken or noted by us:—The Large White (*Pieris brassicae*), the Small White (*P. rapae*), the Green-veined White (*P. napi*), the Orange-tip (*Euchloë cardamines*), the Comma (*Polygonia c-album*), the Wall Brown (*Pararge megera*), the Meadow Brown (*Maniola jurtina*), the Gate-keeper (*M. tithonus*), the Ringlet (*Aphantopus hyperanthus*), the Small Heath (*Coenonympha pamphilus*) the Green Hairstreak (*Callophrys rubi*), the Small Copper (*Lycaena phlaeas*), the Silver-studded Blue (*L. aegon*), the Holly Blue (*Lycaenopsis argiolus*), the Small Blue (*Cupido minimus*), the Small Skipper (*Adopaea sylvestris*), and the Large Skipper (*Ochlodes venata*).

Of the moths — the Broad Bordered Bee Hawk Moth (*Haemorrhagia fuciformis*) and the Yellow-legged Clear-wing (*Aegeria vespiformis*) have been taken by us. The Wood Leopard (*Zeuzera pyrina*) occurs, and its larvae are found in the stems of young elms, etc. The larva of the Elephant Hawk Moth (*Pergesa elpenor*) has been swept up. The beautiful Cream-spot Tiger Moth (*Arctia villica*) has been met with, and we have beaten the Buff Footman (*Lithosia deplana*) off burnt pines

In other orders, one may mention in the Diptera—*Arrhinomyia cloacellae* Kram., *Psilota anthracina* Mg., *Calliprobola speciosa* Rossi, and *Pocota apiformis* Shr., all rare insects. The last-named beautiful species was bred in some numbers from its 'rat-tailed' larvae, taken in a damp rotten beech trunk.

The deer-fly (*Lipoptena cervi* L.) sometimes occurs in numbers on the wing, and settling on one's clothes, and its shining black puparium occurs in the straw in deer-pens.

The Trichopteron *Stenophylax dubius* Steph., of which a male, and subsequently a female, were swept on the banks of a small stream, is a very rare insect, only the type specimen, a male, having been found heretofore in Britain.

A number of Sawflies has been taken. Some of those most worthy of mention are — *Xiphydria camelus* L., a very curious-looking creature, found at rest on cut timber; *Xyela julii* Bréb., *Ametastegia albipes* C. G. Th., *Dolerus nitens* Zadd., *Selandria fürstenbergensis* Know., and *Amauronematus meltonatus* Zadd. The third British specimen of *Diprion polytomum* Ktg. was beaten off spruce. Fortunately no others have been found, as it may become a serious pest. It has been introduced from Europe into Canada, where it has caused immense damage in the spruce forests.

A number of noteworthy Heteroptera and Homoptera has been taken. The ant-like larval stage of *Alydus calcaratus* L. has been found running in company with workers of *F. rufa* L., *F. fusca* and other ants. *Ischnodema sabuleti* Fall. was first taken in a swan's nest, and subsequently swept in some numbers off reeds and other water-plants. The large water-bug *Ranatra linearis* L. occurs in some of the ponds. We made the following observations on the swimming of this creature at Windsor Forest: 'The bug appeared to stand on the water in a slanting position, and using the front legs like a dog swimming and striking out with the back legs, it rushed forward, looking like a minature motor-boat. One speciment swept out and round in a great circle; another went right across the large pond in an incredibly short time, leaving a regular wave, as if from a steamboat, in its wake. The day was warm and sunny, which probably stimulated the creatures, and it looked as if they were taking this exercise purely for pleasure. In the aquarium they are very sluggish and remain submerged beneath the surface of the water.'

Other species worthy of mention are *Corizus maculatus* Fieb., *Aphanus pini* L., *Metatropis rufescens* H.S., *Aradus depressus* F., and *Cardiastethus fasciiventris* Garb.

The large and curious Homopteron *Ledra aurita* L. is found in all its stages by beating hawthorn, oak, etc. We have kept live Windsor specimens at the Natural History Museum, but neither its life-history nor its food is yet known for certain.

Two spiders are of interest, chiefly on account of their unusual habitat. *Meta menardii* Latr., known as the 'Cave Spider,' is a large species which we have found in some numbers in the centre of great trees, oak, beech, etc., after they have been cut down. This spider inhabits caves and extends throughout the mountain limestone districts of England (from Devon to the N. Riding of Yorkshire) and Ireland, but there was no previous record for the South-East of England. The other species, *Tegenaria atrica* C.L.K., constructs large matted webs inside hollow trees in the forest. This spider, usually confined to houses, is nearly related to the 'Hampton Court' or 'Cardinal' spider, *T. parrectina* Fourc.

Windsor Forest may be said to extend from Windsor to Camberley, and to include Windsor Great Park, Windsor Forest and Swinley Forest. The area, therefore, contains the town and the immediate neighbourhood of Windsor. The Park is open to the public on condition that there is no interference with or damage to the trees, or any infringement of the regulations printed on the

notice-boards at the gates. In connection with this subject we regret to have observed an unfortunate result of the kind permission to picnic beyond the roadside among the trees. Not only is much unsightly litter left behind, and hollow trees filled with empty bottles, tins, et., but two valuable old trees have been set on fire, one of them being totally destroyed!

Before entering on the main subject of this paper, it seems desirable to point out, and briefly describe, some of the interesting features of this delightful spot.

Formerly when strolling through the Park one sometimes met a beautiful flock of white (Angora) goats, and it is interesting to observe that their visits to different parts of the Park were determined by the state of the weather. It is perhaps not generally known that this flock is the source whence the Royal Welsh Fusiliers obtain their mascot. By an ancient custom the regiment can, when necessary, claim one or more of these goats, which are of course taken quite young and trained to march with the band. These goats, however, are no longer allowed to be at large in the Park.

All the deer found in the Forest in 1817 or 1818 were surrounded and driven into the Park, where they have given rise to the existing large herds of both fallow and red deer. The red deer are particularly fine, and present a most imposing spectacle when one suddenly comes across a number, with well-developed and spreading antlers, all standing 'at gaze.' The Windsor deer seem to me to be in better condition, and finer, than any I have seen elsewhere, largely due, I believe, to the improvement of the pasturage during recent years.

Highland cattle were formerly kept in the Park, and fortunately they have recently been reintroduced, and form a picturesque addition to the landscape.

The North American grey squirrel has established itself at Windsor for several years. Although undoubtedly an interesting addition to our fauna, and an ornament to the London parks, it is much to be regretted that the invader has extended its range so widely and in such numbers throughout the country.

Pheasants are reared every year in the Park and Forest, although, unfortunately, the soil does not appear altogether to suit this beautiful and useful bird.

In the nineties of the last century a Golden Eagle was captured in Windsor Great Park. It was confined in a wire enclosure at the rear of Cranbourne Tower (William IV's shooting box), where it

lived for many years. It can still be seen, stuffed, in a glass case in one of the rooms of this tower. The celebrated race-horse 'Eclipse' is buried near this tower, the spot being marked with an iron tablet. In the Herefordshire Cattle Farm-house is a stuffed Genet, which was shot in Windsor Forest some time ago, probably an escape from some travelling menagerie or circus.

The Woodcock is known to have nested recently in the Forest, thus creating the second record for Berkshire. Many other interesting birds are of course present. The Nuthatch and the large Green Woodpecker are both common, and one may also see the Lesser Spotted Woodpecker. The presence of the Crossbill has been recorded near Ascot, and the Grasshopper Warbler is sometimes heard in the spring. Owls are not uncommon and deserve to be encouraged for the sake of the benefit they confer in keeping down rats, mice, and other vermin; as do also the Kestrels, which may sometimes be seen on the wing round the tops of the larger trees. The Redstart, a bird which as I am informed has become much scarcer elsewhere, is quite holding its own, nesting in the old oaks at Windsor. A heronry used to exist near Sandpit Gate, but in 1859 the birds were disturbed and moved to the opposite side of the lake at Virginia Water. Here they were unfortunately again disturbed and have now disappeared, though one frequently sees one or two round the ponds and on the wing. Swans nest regularly on the ponds and lakes, and we have seen the Great Northern Diver on Cumberland Lake (where so many water-fowl occur) in the autumn.

A vine which is larger than that at Hampton Court, and probably the largest in the world, grows in the gardens at Cumberland Lodge, producing 1,200 bunches of grapes yearly. It occupies a vinery 138 feet long by 22 feet wide.

It is well known that in spite of tradition the mistletoe rarely grows on the oak. A single example of this uncommon association exists in the forest. There is also a rambler-rose bearing mistletoe near the Castle in the gardens of Queen Adelaide's Cottage.

The celebrated oak of 'Herne the Hunter' no longer exists. It formerly stood in the Home Park, but was blown down in 1863. The spot where it grew is marked by a tablet fixed to a young tree planted by Queen Victoria. It may be of interest to mention a few of the oldest and most celebrated trees. The largest tree in the Forest is an oak about 40 feet in circumference, to be seen between Forest Gate and Highstanding Hill. William the Conqueror's Oak, in the White Deer Enclosure at Cranborne, is a grand old tree

which has borne that name for many centuries, and is believed to be between 1,200 and 1,500 years old. The main stem disappeared long ago, but the portion now standing is one of the side branches, which still shows signs of vigorous life. Of the four trees named after, and chosen by, four of our Queens, the furthest west from Windsor is Queen Charlotte's Oak, a fine tree about 500 years old, growing in Bray Wood. Near to it in the same wood is Queen Anne's Oak, about 470 years old. Queen Victoria's Oak near Highstanding Hill was chosen by Her Majesty as her favourite tree, shortly after her accession. It is probably about 320 years old. Finally, Queen Adelaide's Beech, about 200 years old, stood to the east of Queen Victoria's Oak. This tree was recently blown down, and Her Majesty Queen Mary has planted another beech in its place. A very fine beech in the grounds of Queen Adelaide's Cottage is known as 'Luther's Tree,' having been raised from seed collected from a tree growing on the spot where the great reformer was arrested. Queen Adelaide left this tree in her will to Queen Victoria. Its seeds recently sown in the Park Nursery and transplanted in the Preserves near Virginia Water Lake, within the Great Park, are expected to give rise to a plantation which, like the parent tree, will be associated with the name of Luther.

Close to Ascot Gate is the Parish Boundary Oak, a fine large tree still bearing the mark imprinted on it during the ceremony of 'beating the bounds.'

Before closing this brief account of a few of the trees, mention must be made of the two fine elm avenues. Of these the Long Walk is especially worthy of notice. This noble avenue, containing nearly 2,000 trees, extends for a total length of two and seven-eighths miles, from Windsor Castle to the 'Copper Horse' (the statue of King George III) on Snow Hill. It was commenced in 1680 by the Duke of York and completed by William III. The other avenue is known as Queen Anne's Ride, having been planted during her reign. It is a grassy drive and extends for about three miles from Queen Anne's Gate to Prince Consort Gate. There are also several very fine avenues of lime trees.

(To be continued.)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

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(*Continued from p.* 219.)

'The primary aim of science is to explore the facts of Nature, to ascertain their mutual relations, and to arrange them as far as possible into a consistent and intelligible scheme. This endeavour is the true inspiration of scientific work, as success in it is the appropriate reward. The material effects come later, if at all, and often by a very indirect path.'—HORACE LAMB.

THE COLEOPTERA OF THE WINDSOR FOREST AREA.

CICINDELIDAE.

Cicindela campestris L. The common 'Tiger-beetle.' Widely distributed in sandy places. (v, vi, viii.) *

CARABIDAE.

Cychrus rostratus L. At roots of trees, under boards, logs, and in sand-pits. Widely distributed but not common. (v, vi, vii, ix.)

Carabus catenulatus Scop. Widely distributed and sometimes

* The habitats, months of capture, rarity or otherwise, refer only to my Windsor experience.

abundant, on paths, under bark, etc.; 20 in a trench in a sand-pit (7.x.30). (iii, iv, v, viii, x.)

C. nemoralis Müll. Under boards, on paths; scarce. (v, vi.)

C. violaceus L. Under bark, and at roots of trees, etc.; rarer than *C. catenulatus*. (iv, v, vii, ix, x.)

C. granulatus L. One under piece of wood, x.1923.

C. monilis F. On paths; rare. (vii.)

C. arvensis F. 'Windsor' (Stephens, 1839). Under bark, x.1936 (Allen and Donisthorpe).

Calosoma inquisitor L. 'It was once taken in profusion by Mr. W. Griesbach near Windsor' (Stephens, 1828).

Notiophilus biguttatus F. At roots of trees, on paths, in sand-pits, etc.; common, and widely distributed. (iii, iv, v, vii, viii, ix.)

N. substriatus Waterh. By sweeping, and on paths; local and rare. (vi, viii.)

N. 4-punctatus Dej. In sand-pit; very local and rare. (iv.)

N. aquaticus L. Running on paths and open ground; very local and scarce. (vi.)

N. palustris Duft. In sand-pit, on paths, under cut bracken; local and not common. (iv, vii, ix, x.)

N. rufipes Curt. In dead leaves and running on the ground in beech woods. This handsome species is sometimes abundant. (v, viii, ix, x.)

Leistus spinibarbis F. Common and widely distributed, under bark, in dead leaves, etc. (iii, v, ix, x.)

L. fulvibarbis Dej. Running on grassy path, and in burnt area; decidedly scarce. (v, ix.)

L. ferrugineus L. Not common; under wood-stacks, on logs, on burnt area, sweeping. (vi, viii, ix.)

Nebria brevicollis F. Common, at roots of trees, under logs, etc. The larva throws up casts from its burrows as a bee does. Bred from a larva taken 1.ii, pupated 28.ii, emerged 8.iv. (ii, iii, v, viii, ix, x.)

N. iberica Ol. Very local, but not uncommon under stones in more open sandy country (ix.)

Elaphrus riparius L. Common in marshy places, at edges of ponds, etc. (iv, v, vi, viii.)

E. cupreus Duft. In company with the former; equally common. (iv, vi, viii.)

Loricera pilicornis F. Under dead leaves around ponds, in marshy places, on surface of dried up pools, etc.; common. (v, vi, viii, ix.)

Clivina fossor L. Under stones, in mud of dry stream, in moss, flood refuse, etc.; not common. (iv, v, viii.)

Dyschirius aeneus Dej. On mud around ponds, in reed refuse, etc.; not common. (v, vi, vii, ix.)

D. globosus Hbst. In moss in willow-swamp, in *Sphagnum*; scarce. (v, vii, ix.)

Badister bipustulatus F. In flood refuse, moss, cut grass; one in mole's nest; not common. (iii, v, xii.)

Chlaenius vestitus Payk. On mud around ponds; scarce. (vi, vii.)

C. nigricornis F. On mud around pond; rare. (vi.)

Stenolophus vespertinus Panz. Abundant on mud round ponds, and on surface of dried ponds; by sifting swan's nest, etc. (v, vi, vii, viii, ix.)

Acupalpus flavicollis Sturm. Scarce in reed-refuse. (iii, v, vii.)

A. dorsalis F. In moss; abundant on dry bottom of swamp. (v, viii.)

A. exiguus Dej., v. *luridus* Dej. Common in moss in willow-swamps, sifting swan's and moorhen's nests, on margins of ponds. The typical form has not been found. (iii, iv, v, vi, viii.)

A. brunnipes Sturm. In damp spot near ditch, sweeping and beating faggots in willow-swamp; rare. (v, viii, ix.)

A. meridianus L. Banks of pond, in moorhen's nest, sweeping and beating faggots in willow-swamp; scarce. (v, vi.)

A. consputus Duft. In moss in willow-swamp; rare. (v, vii, x.)

Bradycellus sharpi Joy (*distinctus* Fowler *nec* Dej.). In reed-refuse and in moss; local and not common. (iii, v, x.)

B. verbasci Duft. In moss; abundant by evening sweeping. (iv, viii, x, xi.)

B. harpalinus Dej. In sand-pit, moss, etc., abundant by evening sweeping. (iv, viii, x, xi.)

B. similis Dej. By beating fir tops, evening sweeping, in sand-pits; common. (v, viii, ix.)

Harpalus brevicollis Dej. In cut grass, flood-refuse, etc.; scarce. (i, ix.)

H. puncticollis Payk. By sweeping; rare. (vii.)

H. angusticollis Müll. Sweeping Umbelliferae and grass; locally abundant. (viii.)

H. ruficornis F. On paths, under stones, etc., in sand-pits; common. (v, vi, vii, viii.)

H. aeneus F. Under stones, on paths, in sand-pits, etc.; common. (iv, v, vi, vii.)

H. rubripes Duft. In damp spots, in sand-pits, and on the wing in hot sunshine; not common. (v, vii.)

H. caspius Stev. 'Near Windsor' (Stephens, 1839).

H. latus L. 'Found at Windsor' (Stephens, 1832). On paths and roads, in moss, in sand-pit, and on the wing; not common. (v, vi.)

H. tardus Panz. In cut grass refuse; scarce. (viii.)

H. nigripalpis Steph. 'Taken near Windsor' (Stephens, 1832). There is no insect under this label in the Stephensian collection; nor is it mentioned in G. R. Waterhouse's catalogue (1858). It was possibly a form of *H. honestus* Duft.

H. honestus Duft. In sand-pit; scarce. (v.)

Anisodactylus binotatus F. Running on paths and roads, in moss in dry pond; local, but not uncommon. (v, vii.)

A. binotatus F., v. *spurcaticornis* Dej. In moss and on roads; scarce. (v.)

A. nemorivagus Duft. Under stones and by sweeping; scarce. (ix.)

A. atricornis Steph. Under stones; scarce. (x.)

Stomis pumicatus Panz. At roots of trees, under logs, etc.; scarce. (vii.)

Pterostichus cupreus L. Under stones, running on grassy paths, in willow-swamp; not common. (iv, v.)

P. coerulescens L. (*versicolor* Fowler). On paths and roads, in sand-pits, etc.; rather common. (v, viii.)

P. lepidus F. Very scarce; one pair *in cop.* in sand-pit (30.v.30).

P. madidus F. In cut-grass, sand-pits, roots of trees, flood-refuse, etc.; common. (iii, iv, v, vi, vii, viii, ix, x.)

P. oblongo-punctatus F. 'Near Windsor. . . . Dr. Leach' (Stephens, 1828). I have never taken this species in Windsor Forest, though I have hunted for it for 15 years, under chips of wood, etc. I believe Stephens' record refers to the following species.

P. angustatus Duft. In sand-pit after a fire had passed over it; under chips near burned stump; abundant running on burnt ground; very local. (v, vi, vii, viii, ix, xi.)

P. niger Schall. Under wood-stacks, fungus dumps, in tree stumps, etc.; common under loose bark. (iv, vi, vii, viii, ix, x.)

P. vulgaris L. In sand-pit and on roads; scarce. (vi, vii, ix.)

P. anthracinus Ill. Under stones in damp spot (10.v.93); I have never been able to find it again.

P. nigrita F. In damp places, in *Sphagnum,* running on mud round ponds; common. (iii, iv, v, vi.)

P. minor Gyll. In dead leaves round pond, in *Sphagnum,* moss in willow swamp, reed refuse, etc. ; not uncommon. (iv, v, vi, vii, viii.)

P. strenuus Panz. In flood-refuse, moss, *Sphagnum,* etc. ; common. (iv, v, x.)

P. diligens Sturm. In the same habitats as the former and equally common. (iv, v, x.)

P. picimanus Duft. Under stones and at roots of trees ; scarce. (iv, v, vii.)

Abax striola F. Under wood-stacks, logs, dead leaves, fungus dumps, etc. ; common. (v, vi, vii, viii, ix, x.)

Amara apricaria Sturm. Under boards ; scarce. (vii.)

A. aulica Panz. By sweeping thistles in flower, fleabane, under boughs and boards ; not common. (vii, viii.)

A. bifrons Gyll. Under stones on sandy ground ; local and not common. (ix.)

A. ovata F. On grass stems, on roads ; scarce. (v, vi.)

A. similata Gyll. On paths and roads, under boards, beating hawthorn-blossom ; abundant by sweeping *Matricaria.* (v, vi, vii, ix.)

A. tibialis Payk. Under stones ; scarce. (v.)

A. lunicollis Schiödte. In cut grass, sand-pits, etc. ; not common. (iv, v, vii, ix.)

A. famelica Zimm. Running on path ; very scarce. (vii.)

A. familiaris Duft. In cut grass, on roads and paths, and in sand-pit ; not uncommon. (iv, v, vi, vii, ix.)

A. trivialis Gyll. On roads and paths, under boards, in sand-pits ; rather common. (iv, v, vi, vii, viii, ix, x.)

A. communis Panz. On road ; very scarce. (v.)

A. continua Thoms. In moss ; scarce. (iv.)

A. plebeia Gyll. On paths and roads, under leaves, in moss, in dry ditch, etc. ; not very common. (v, vi, viii.)

Calathus cisteloides Panz. On burnt ground, under boards, in loose hay, etc. ; not uncommon. (vii, viii, ix.)

C. flavipes Fourc. In sand-pits and under stones ; abundant running on burnt ground. (vii, viii, ix.)

C. melanocephalus L. In cut grass, under boards, stones, etc. ; not uncommon. (vi, vii, ix.)

Amphigynus piceus Marsh. At roots of trees, in sand-pits, on grassy paths, etc. ; rather common. (iii, iv, v, vii, viii.)

Anchomenus angusticollis F. Under bark of trees ; by beating dead branches of lime trees ; rather common. (iii, iv, vii, viii, ix, xi.)

A. dorsalis Müll. Running on road ; scarce. (vii.)

A. albipes F. In flood refuse, willow swamps, margins of ponds, etc.; very abundant. (iv, v, vi, vii.)

A. oblongus Sturm. In moss and by beating faggots in willow swamp, sifting reed-refuse, etc.; common. (iv, v, vi, ix.)

A. marginatus L. Abundant on mud round pond; very local. (iv, vi.)

A. sexpunctatus L. In damp ditches and marshy places, one on dry heath ground, one in sand-pit; not common. (v, vi, vii.)

A. parumpunctatus F. In damp spots, by sweeping, and on the wing; not common. (v, ix.)

A. viduus Panz. On mud round pond and on mud of dried-up pond; not very common. (vi, vii, viii.)

A. viduus Panz., v. *moestus* Duft. In moss in willow-swamp; scarce. (iv, v.)

A. viduus Panz., v. *emarginatus* Gyll. In moss in willow-swamp; scarce. (ix.)

A. micans Nic. In moss in willow-swamp, and in *Sphagnum*; not uncommon. (iv, v, vi, vii, ix.)

A. scitulus Payk. In moss in willow-swamp; very scarce. (x.)

A. fuliginosus Panz. In *Sphagnum*, roots of grass round ponds, in moss in willow-swamp; common. (iv, vi, ix.)

A. gracilis Gyll. By sweeping reeds, running on mud, in reed refuse, etc.; not common. (v, vi, ix.)

A. thoreyi Dej. In moorhen's nest; not common. (vi.)

A. puellus Dej. In swan's and moorhen's nest, in reed refuse; not uncommon. (v, vi.)

A. quadripunctatus De G. Very local; abundant on burnt ground. (vii, ix.)

Olisthopus rotundatus Payk. Under stones, in sand-pit, on burnt ground, at edges of stream, etc.; not common. (v, vii, viii.)

Bembidion rufescens Guér. By beating faggots in willow-swamp; always by beating dead branches on living trees; not uncommon. (v, vii, viii.)

B. obtusum Sturm. In flood-refuse, at edges of ponds; common in moss in willow-swamp. (v, viii, ix, x, xi.)

B. guttula F. In manure-heap, dead leaves and grass, banks of ponds, moss in flood-refuse; common. (iii, iv, v, vi, ix, x.)

B. mannerheimi Sahlb. In flood-refuse, under dead leaves, in sand-pit, sweeping, etc.; common. (ii, iv, v, ix.)

B. biguttatum F. In moss in willow-swamps, on mud around ponds, etc.; common. (iii, iv, v, ix.)

B. lunulatum Fourc. In damp and marshy places, *Sphagnum*,

moss in willow-swamps; very common. (iv, v, vii, viii, ix, x, xi.)

B. clarki Daws. In moss in willow-swamp, and in *Sphagnum*; local. (v, vi, viii, ix, x.)

B. articulatum Panz. On muddy edges of streams and ponds; common. (v, vi, ix.)

B. doris Panz. On borders of streams and edges of ponds; abundant on mud of dried-up pond and in *Sphagnum* swamp; local. (iv, v, vii, viii, ix.)

B. gilvipes Sturm. In moss in willow-swamp; very local and scarce. (v, ix.)

B. lampros Hbst. On paths, edges of ponds, in damp places, sand-pits, etc.; common. (iv, v, vi, viii, ix.)

B. nitidulum Marsh. In sand-pits, on banks of streams and ponds, etc.; rather common. (iv, vi, vii, viii, ix.)

B. 4-guttatum F. On muddy banks of ponds and streams; fairly common. (v, viii.)

B. 4-pustulatum Gyll. In damp places; very local. (v, vi, vii.)

B. 4-maculatum Gyll. In wet moss, running on mud and paths in damp places; not uncommon. (v, vi, viii, ix, x.)

B. concinnum Steph. In sand-pit; very scarce. (ix.)

B. femoratum Sturm. In damp sandy place; scarce. (v.)

B. bruxellense Wesm. In *Sphagnum* and on margins of ponds; not common. (iv, v, vii.)

B. litorale Ol. In marshy places, flood-refuse, on mud, etc.; not uncommon. (v, vii, viii.)

B. flammulatum Clairv. In dead leaves around ponds; abundant on muddy banks of stream, etc. (iv, v, vi, viii.)

B. varium Ol. On mud around pond; scarce. (vii.)

Tachypus flavipes L. On mud around pond, on paths and grassy rides; not uncommon. (iv, vi.)

Trechus micros Hbst. 'Windsor. Dr. Leach' (Stephens, 1828).

T. minutus F. In cut reeds and herbage, at roots of trees, at Cossus tree, in fungi, by sweeping, etc.; common. (iv, viiii, ix, x, xi.)

T. obtusus Er. Under boughs, and at edges of pond; scarce. (v, vii.)

T. secalis Payk. In cut reed refuse; scarce. (viii.)

Patrobus excavatus Payk. Under stones, on mud, in flood-refuse, moss, etc.; not uncommon. (v, viii, ix.)

Cymindis humeralis Fourc. 'Rare . . . Windsor' (Stephens, 1839). There is a specimen in the Stephensian Collection.

Lebia cyanocephala L. 'Out of common broom . . . it has also been taken at Windsor' (Stephens, 1828).

L. crux-minor L. 'I have a male which was captured near Windsor' (Stephens, 1828).

Demetrias atricapillus L. In grass, loose hay, beating dead branches on lime trees, sweeping, etc.; common. (iv, vi, vii, viii, x.)

Dromius linearis Ol. In damp places, at roots of rushes, beating fir tops, hawthorn, faggots, etc.; common. (iv, v, vi, ix, x.)

D. angustatus Brullé. In hawk's nest in some numbers; by beating fir tops, on cut pines; very local. (v, ix.)

D. agilis F. Under bark of various trees, by beating spruce, pines, hawthorn, limes, etc.; rather common. (iii, iv, v, vi, vii, viii, ix, x.)

D. meridionalis Dej. In similar situations to the above, and equally common. I took an aberration with two yellow spots on the elytra, like ab. *bimaculatus* Dej. of *agilis*, under bark at Windsor (4.xi.27). (vi, vii, x, xi.)

(To be continued.)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

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(*Continued from Vol. LXXII, p.* 267)

D. 4-maculatus L. Under bark, by sweeping, beating dead branches, etc.; very common. (v, vi, vii, viii, x.)

D. 4-notatus Panz. In similar situations to the above, and equally common. (ii, v, vi, vii, viii, ix, x.)

D. melanocephalus Dej. In sand-pits, under bark, by beating faggots, dead branches, etc.; common. (iv, v, ix, x, xi.)

Blechrus maurus Sturm. By evening sweeping, in cut grass.

abundant at roots of elm trees, and once in numbers under dead bird; common. (iv, v, vii, viii.)

Metabletus foveola Gyll. Under stones, in fern-refuse and moss, and running on burnt ground; not uncommon. (iv, vii, vii, ix, xi.)

M. obscuro-guttatus Dufts. In loose hay, on cut-up wood, and by sweeping; not common. (iv, v, vi, ix.)

Polystichus vittatus Brullé. I once took two specimens at the roots of elm trees (14.v.24); very scarce.

The Water-beetles have not yet been thoroughly worked, although water is abundant. The lakes at Virginia Water are the largest pieces of water; there is also a lake near Swinley; and Cumberland Lake, already mentioned, is also called Great Meadow Pond. The largest ponds are Cow Pond, beautifully situated near the Rhododendron Ride, Russell Pond, and Bear's Rails Pond. Water-lilies grow in all three. The last-mentioned pond was in existence at the time of Edward the Confessor, who had a palace nearby. A rivulet runs into it, and water escapes by a drain at the other end, and it is good for fishing. There are other smaller ponds, streams and rivulets.

HALIPLIDAE.

Haliplus flavicollis Sturm. In ponds; not uncommon. (v, vii.)

H. ruficollis De G. In ponds and lakes; abundant in small stagnant pond. (iv, vi, ix, x.)

H. heydeni Wehnck. In ponds; scarce. (iv.)

H. fluviatilis Aubé. In Bear's Rails Pond; scarce. (iv.)

H. wehnckei Gerh. In ponds; scarce. (iv.)

H. maculatus Gerh. Common in large pond. (iv, v, vii.)

H. immaculatus Gerh. In old canal. (viii.)

H. lineatocollis Marsh. In ponds, water-trough, by sweeping; common. (iv, v, vii, viii, ix.)

Cnemidotus impressus F. In pond; scarce. (iv.)

PELOBIIDAE.

Pelobius tardus Hbst. In pond; very local and scarce. (iv, v.)

DYTISCIDAE.

Noterus clavicornis De G. (the smaller species). In small lake; scarce. (iv.)

N. sparsus Marsh. Abundant in ponds; in some numbers in a water-fowl's nest. (iv, v, viii, ix.)

Laccophilus obscurus Panz. In ponds; not uncommon. (iv, v, ix.)

Hyphydrus ovatus L. In ponds; common. (iv, v, ix.)

Coelambus inaequalis F. In lake; common in ponds. (iv, v, vii, ix.)

Hydroporus pictus F. Common in ponds. (iv, ix.)

H. lepidus Ol. In *Sphagnum* pool; and abundant in a small deep pool on a heath. (iv, v.)

H. dorsalis F. In pond; scarce. (v.)

H. lineatus F. In large pond; scarce. (v.)

H. neglectus Schm. In pond; scarce. (v.)

H. tristis Payk. In small deep pool on heath, and in *Sphagnum* pond; not uncommon. (iv, v, vi, vii.)

H. angustatus Sturm. In ponds, flood-refuse, and in *Sphagnum* pool; not uncommon. (iv, v, vii, ix.)

H. gyllenhali Schdt. In *Sphagnum* pools, ponds, streams, etc.; very common. (iv, v, vi.)

H. palustris L. In ponds, in willow-swamp, and in small streams; common. (iv, v, vi, vii, ix.)

H. erythrocephalus L. In ponds; not uncommon. (iv, v, ix.)

H. memnonius Nic. In small puddle, in ponds, and small streams; not uncommon. (iv, v, vi.)

H. obscurus Strm. Common in *Sphagnum* swamp. (v, vii, viii.)

H. nigrita F. In pond in stream, and deep pool on heath; scarce. (v, vi, vii.)

H. discretus Fairm. In small rivulet into pond; scarce. (v.)

H. pubescens Gyll. In ponds, streams, etc.; abundant. (iv, v, vi, vii.)

H. planus F. In ponds, etc.; very common. (iv, v, vii, viii.)

H. lituratus F. In drinking-troughs, in streams, etc.; not uncommon. (iv, v, viii, x.)

Agabus guttatus Payk. Common in running streams. (iv, v, vi.)

A. uliginosus L. 'Captured near Windsor' (Stephens, 1829).

A. affinis Payk. Common in *Sphagnum* swamp. (v, vii.)

A. didymus Ol. In muddy stream, in rivulet running into pond; not common. (iv, v.)

A. nebulosus Först. In *Sphagnum* swamp; scarce. (v.)

A. abbreviatus F. 'Windsor, Dr. Leach.' (Stephens, 1829.)

A. sturmi Gyll. In ponds, etc.; common. (iv, v, vi.)

A. chalconatus Panz. In muddy puddle, flood refuse, *Sphagnum* pool, etc.; not uncommon. (v, vii, viii, ix.)

A. bipustulatus L. In drinking-troughs, puddles, ponds, etc.; common. (iv, v, viii, ix, x.)

Ilybius fuliginosus F. In ponds and streams; not uncommon. (v, vi, ix.)

I. fenestratus F. In ponds; not as common as the above. (iv, v, vi, vii.)

I. ater De G. In pond; scarce. (v.)

I. aenescens Th. In ponds and *Sphagnum* pool; not common. (iv, v, vi.)

Copelatus agilis F. In ponds; scarce. (v.)

Rhantus exoletus Först. In ponds and *Sphagnum* pool; not uncommon. (iv, v, vi.)

R. pulverosus Steph. In ponds; not common. (v, vii.)

Colymbetes fuscus L. In ponds and small lakes; abundant in pot-hole in willow-swamp. (iv, v, ix.)

Dytiscus punctulatus F. In small stream, and in *Sphagnum* pool; scarce. (v, viii.)

D. marginalis L. In pool in stream, in rivulet into pond, in pot-hole in willow-swamp; not uncommon. (iv, x.)

Acilius sulcatus L. In stream; scarce. (iv.)

GYRINIDAE.

Gyrinus natator Scop. var. *substriatus* Steph. In water-trough, pools in stream, and ponds; common. (iv, v, viii.)

Orectochilus villosus Müll. In moss in waterfall; scarce. (vi.)

HYDROPHILIDAE.

Hydrobius fuscipes L. In muddy puddle, pools, ponds, etc.; common. (iv, v, vi.)

H. fuscipes L. ab. *chalconotus* Steph. In pond; scarce. (iv.)

H. fuscipes L. ab. *subrotundatus* Steph. In ponds, *Sphagnum* pool, etc.; not common. (iv, v.)

Philydrus testaceus F. In ponds; in some numbers in a water fowl's nest. (iv, v, viii, ix.)

P. nigricans Zett. In *Sphagnum* pool, ponds, etc.; not uncommon. (iv, v, viii.)

P. melanocephalus Ol. In large pond, and in *Sphagnum* swamp; scarce. (iv, viii.)

P. minutus F. Very local; not uncommon in *Sphagnum* swamp. (iv, vii, viii.)

P. coarctatus Gred. In ponds; common. (iv, vi, ix.)

Anacaena globulus Payk. In ponds and streams, cut hay, refuse, etc.; common in grassy pool. (iv, v, viii, ix, xi.)

A. limbata F. In moss, moorhen's nest, ponds, pot-hole in willow-swamp, etc.; common. (iv, v, vi, vii.)

A. bipustulata Steph. In large pond; very local. (v.)

Helochares lividus Först. In ponds; abundant in *Sphagnum* pool; a pupa taken under a log in mud of pond, 10.ix.29, emerged 14.ix.29; common. (iv, v, vii, ix.)

H. punctatus Sharp. In pond, in ditch, in moss, sweeping; not common (iv, v, ix.)

Laccobius alutaceus Th. In pond and on mud round pond; very local. (v, vi, vii.)

L. minutus L. In ponds, flood refuse, etc.; abundant. (iv, v, vii.)

L. ytenensis Sharp. In pond; very scarce. (iv.)

Berosus signaticollis Charp. In *Sphagnum* pool; very local. (v, vi.)

B. luridus L. In pond, in *Sphagnum* swamp; not uncommon. (v, vi.)

Limnebius truncatellus Thunb. In gravel in shallow ditch, in flood refuse, and in streams; not common. (vi, viii, ix.)

L. papposus Muls. In gravel in shallow ditch, on mud round pond, and in moss round pot-hole; scarce. (vi, vii, viii.)

L. nitidus Marsh. In numbers in mud round pond, in moorhen's nest, in stream, etc.; not uncommon. (iv, v, vi.)

Chaetarthria seminulum Hbst. In *Sphagnum*; scarce. (viii.)

Spercheus emarginatus Schall. 'This rare insect . . . has occurred at Windsor' (Stephens, 1829).

Helophorus porculus Bedel. Sweeping *Matricaria*; scarce. (vi.)

H. aquaticus L. In muddy puddle, in ponds and streams; common. (iv, v.)

H. aequalis Th. In rivulet into pond and in streams; not common. (iv, vi.)

H. dorsalis Marsh. In stream, and a dozen specimens in puddle in mud near stream; very local and rare. (iv, v.)

H. aeneipennis Th. In ponds, streams, water troughs, cut reeds, etc.; abundant and common. (iv, v, vi, viii.)

H. walkeri Sharp. In stream; very scarce. (iv.)

H. strigifrons Blkb. Very local; in moss in willow swamp; sometimes in some numbers. (iv, v, vi, ix, x.)

H. affinis Marsh. In runlets, ponds, ditches, moss; not very common. (iv, v, viii, ix.)

H. brevipalpis Bedel. In moss, ponds, streams, etc.; exceedingly common and abundant. (iv, v, vi, vii, ix, x.)

Hydrochus angustatus Germ. In pond, and in some numbers in deep pool on heath; local. (iv, v.)

Ochthebius pygmaeus F. In ponds and streams, in moss in willow swamp; not very common. (iv, v, vii, viii, ix.)

O. bicolor Germ. In moorhen's nest, in mud of dry pond; not common. (vi, ix.)

O. rufimarginatus Steph. In small stream; scarce. (v.)

Hydraena testacea Curt. In pond and stream, in moss in willow-swamp; not common. (iv, v, viii.)

H. riparia Klug. In pond, in moss round pot-hole; scarce. (iv, vii.)

H. nigrita Germ. In shingle, and in numbers under stones in small stream; local. (iv, v, vii.)

Cyclonotum orbiculare F. In moorhens' nests; in some numbers at edge of pond, just submerged; local. (vi, vii.)

Sphaeridium scarabaeoides F. On grass stems, and in dung; not very common. (iv, vi, vii.)

S. 4-maculatum Marsh. Abundant in cow-dung. (iv, vii, viii.)

S. bipustulatum F. In manure-heaps, flood-refuse, dead pigeon, decaying wood, cow-dung, etc.; common. (iv, v, vi, viii, ix.)

S. bipustulatum F., ab. *marginatum* F. In manure-heaps, and in numbers in cut grass. (v, vi.)

Cercyon haemorrhous Gyll. In swan's nest, in submerged log, and abundant on mud round pond; local. (vi.)

C. haemorrhoidalis Hbst. In manure-heaps, in swan's nest, on bones, in cow-dung; common. (iv, v, vi, viii, ix.)

C. obsoletus Gyll. In cow-dung; local and not common. (iv, v, vi.)

C. marinus Th. In numbers at roots of aquatic plants, and by treading in moist places at edge of lake; very local. (vii.)

C. aquatilis Donis. Two specimens were taken by fishing in pot-hole in willow-swamp, 26.iv.32.

C. flavipes F. In cut grass, moorhen's nest, cow-dung, etc.; common. (v, vi, viii, ix.)

C. lateralis Marsh. In cut grass, dead pigeon, wild honeybee's comb, fungi ('sulphur bracket,' *Polyporus sulphureus*, etc.); common. (viii, ix, xi.)

C. melanocephalus L. In cut grass, decaying fungi; abundant in cow-dung; common. (iv, vii, viii, ix.)

C. unipunctatus L. In flood-refuse, cut grass, dead pigeon, etc.; not uncommon. (i, v, viii.)

C. quisquilius L. In cut grass and cow-dung; not uncommon. (v, ix.)

C. nigriceps Marsh. In decaying fungus, manure-heaps, and cut grass; not uncommon. (ix, x.)

C. pygmaeus Ill. In manure-heaps, cut grass, and fungi; not uncommon. (vi, viii, ix.)

C. terminatus Marsh. In manure-heap, flood-refuse; in some numbers in cut grass; local. (v, vi, ix, xii.)

C. analis Payk. In cut grass, hay-refuse, and swans' nests; common. (vi, ix.)

C. lugubris Payk. In moss in willow-swamp, in numbers under log in water, in moorhens' nests, in fungi, etc.; common. (iv, vi, vii, viii, ix.)

Megasternum boletophagum Marsh. In manure-heaps, fungi. flood refuse, etc.; frequently by evening sweeping; very common. (i, v, vi, viii, ix.)

Cryptopleurum atomarium Muls. In deer's dung, fungus dumps, swans' nests, etc.; also by evening sweeping; common. (iv, v, vi.) Numbers were flying together up and down over a pool in a stream, 30.iv.33.

STAPHYLINIDAE.

Aleochara fuscipes F. In dead birds and animals, in fungi; very common. (v, vi, vii, viii.)

A. lata Grav. On bones, in dead birds and rabbit; not common. (v, vi, viii, ix.)

A. crassicornis Lac. In decaying fungi; very rare. (x.)

A. brevipennis Grav. v. *curta* Sahlb. (*fumata* Fowler). By sweeping; scarce. (vii, viii.)

A. discipennis Muls. Under cow- and horse-dung; very rare. (v.)

A. crassiuscula Sahlb. In hot manure-heaps and cut grass; local but not uncommon. (v, vi, viii, ix.)

A. tristis Grav. In sappy decaying wood; rare. (ix.)

A. bipunctata Ol. In cow-dung, moss in willow-swamp, sweeping; not common. (v, vi.)

A. cuniculorum Kr. Several specimens deep down in badger's earth; very local and scarce. (v.) This species is usually found in rabbit-burrows.

A. lanuginosa Grav. In manure-heaps, cow-dung, straw, etc.; very abundant in deer's dung; very common. (ii, iii, iv, v, vi, vii, viii.)

A. lygaea Kr. By sweeping; very rare. (vii.)

A. diversa Sahlb. (*moesta* Er.). In decaying fungi, hornets' comb, dead squirrel, Cossus frass, etc.; widely distributed and not uncommon. (vii, viii, ix, x, xi.)

A. sparsa Heer (*succicola* Th.). Under similar circumstances to the above, but more common. (iii, viii, ix, x, xi.)

A. moerens Gyll. In fungus traps; very local and rather scarce. (viii, ix, x.)

A. sanguinea L. (*brunneipennis* Kr.). In nest of *Acanthomyops* (*D.*) *brunneus*, and by beating lime trees; very scarce. (vi, vii.)

A. nitida Grav. On bones, in moss in willow-swamp, by sweeping; once abundant *in stercore*; not uncommon. (iv, vi, vii, viii.)

A. spadicea Er. Common in mole's nests. (iii, vi.)

Exaleochara morion Grav. In manure-heap, on bones, and in straw; not common. (vi, vii, viii.)

Microglossa suturalis Sahlb. In nests of *A.* (*D.*) *brunneus*, in grey squirrels' and birds' nests, in straw, etc.; common. (iv, vi, vii, viii, x.)

M. marginalis Gyll. Abundant in birds' nests, in bat's roost, and on bones. (ii, vi, vii, viii, ix.)

M. pulla Gyll. In nest of *A.* (*D.*) *brunneus*, and in birds' nests; not common. (v, vii.)

M. nidicola Fairm. By sweeping. (vii.) The proper habitat of this species is the nests of sand-martins.

M. gentilis Märk. In company with *A.* (*D.*) *brunneus* and *A.* (*D.*) *fuliginosus*; in various birds' nests, abundant in owl's nest refuse; on dead squirrel and on bones. (ii, vi, vii, viii, ix, xi.)

Oxypoda lividipennis Mann. In moles' nests, and by sweeping; not uncommon. (ii, ix, x, xi.)

O. vittata Märk. In company with *A.* (*D.*) *fuliginosus*; not uncommon. (v, vii, ix, x.)

O. opaca Grav. On bones, on the wing, etc.; not common. (iv, vii.)

O. alternans Grav. Abundant in fungi, especially *Polyporus intybaceus* ('cock of the woods' fungus). (ix, x, xi.)

O. filiformis Redtb. In straw-refuse; two specimens in 1933, and four in 1934. Windsor Forest is the only known locality in Britain for this rare species.

O. umbrata Grav. At roots of trees, on cut timber, in moss in willow-swamp, by sweeping, etc.; not uncommon. (iv, v, vi, vii, viii, ix.)

O. salictaria Donis. A few specimens of this new species have been taken in moss in willow-swamp (v, x).

O. nigrina Waterh. In manure-heap, in birds' nests, on mud round pond, etc.; not uncommon. (ii, v, vi, vii.)

O. longiuscula Grav. In moss in willow-swamp, in reed-refuse, in swan's nest, etc.; common and widely distributed. (iv, v, vi, vii, viii, ix, x.)

O. nigrocincta Muls. About a dozen specimens of this rare species have been taken in moss in willow-swamp. (v, vi.) Yarn-

ton, near Oxford, where I first took it in 1924, is the only other known British locality.

O. formiceticola Märk. In nests of *Formica rufa*; common. (iii, ix, x.)

O. recondita Kr. In some numbers in nests of *A.* (*D.*) *brunneus*; also with *A.* (*D.*) *fuliginosus*, and in birds' nests. (v, vii, viii, ix, x.)

O. haemorrhoa Mann. Common in nests of *Formica rufa*; also in hay refuse, etc. (iii, iv, v, ix, x.)

O. annularis Sahlb. In mould under tree-stump, and in company with *A.* (*D.*) *fuliginosus*; scarce. (v, ix, x.)

O. pilosicollis Bernh. Taken by Dr. Joy in a log of wood in Windsor Forest, Easter, 1926. This is the only known British specimen, and is now in the National Collection. Curiously enough it is not even mentioned in Dr. Joy's 'Practical Handbook of British Beetles.'

Thiasophila angulata Er. Common in nests of *Formica rufa*. (iii, ix, x.)

T. inquilina Märk. In company with *A.* (*D.*) *fuliginosus*; not common. (v, vi, viii, ix.)

Ischnoglossa prolixa Grav. Under bark of beech and other trees; common. (ii, iii, vii, viii, ix.)

I. corticina Er. Under oak bark; very scarce. (vii.)

Ocyusa incrassata Muls. In old oak stump, in sand-pit and dead leaves; scarce. (v.)

O. maura Er. In moss in willow-swamp, in moorhens' and swans' nests, sweeping in marsh, etc.; not uncommon. (iv, v, vi, vii, viii.)

O. picina Aubé. In moorhen's nest and by sweeping in marsh; rather scarce. (v, viii.)

Phloeopora reptans Grav. Under oak, poplar, spruce and Scots pine bark, in 'birch bracket' (*Polyporus betulinus*), and in sawdust; common. (iv, vi, vii, viii, ix, x.)

P. angustiformis Baudi. Under oak bark, in 'birch bracket,' and in burrows of *Pityogenes bidentatus*; not uncommon. (v, vi, vii, viii, x.)

P. teres Grav. Under oak bark and on fresh-cut beech logs; scarce. (iv, vi, viii, x.) First taken in Britain in Windsor Forest by me, 9.viii.25.

Ocalea castanea Er. In flood-refuse, and on muddy edge of stream, etc.; not uncommon. (vi, vii, viii, ix.)

O. badia Er. In flood-refuse; scarce. (viii.)

(*To be continued.*)

(*Continued from p. 28.*)

O. puncticollis Muls. and Rey. In moss; rare. (vi, x.) Three specimens only have been taken in Britain, Windsor Forest, 1935 and 1936.

Ilyobates nigricollis Payk. In moss in willow-swamp, under wet refuse, and in moss; scarce (v, vii.)

I. propinquus Aubé. In company with *A.* (*D.*) *brunneus*; very scarce. (vi.)

Calodera riparia Er. In moss in willow-swamp; not common. (iv, v, x.)

C. rufescens Kr. In moss in willow-swamp; scarce. (v, vi, x.)

C. aethiops Grav. In moss in willow-swamp, and by sweeping; scarce. (v.)

Chilopora longitarsis Er. In flood-refuse; scarce. (v.)

Dinarda märkeli Kies. In nests of *Formica rufa*; once in some numbers. (v, ix, x.)

D. dentata Grav. A certain number of specimens in company with *Formica sanguinea*. (v, viii.)

Atemeles emarginatus Grav. Larvae and imagines in nests of *Formica fusca*, one in a nest of *F. sanguinea*. (v, vi, vii, viii.)

Myrmedonia limbata Payk. In company with *A.* (*D.*) *brunneus* and *A.* (*D.*) *fuliginosus*; in moss with *Myrmica laevinodis* and *A.* (*C.*) *flavus*; scarce. (v, vi, ix.)

M. funesta Grav. Common in company with *A.* (*D.*) *fuliginosus*. (iii, v, viii, ix, x.)

M. humeralis Grav. In company with *A.* (*D.*) *fuliginosus*; not common. (iii, v, ix, x.)

M. cognata Märk. In some numbers in company with *A.* (*D.*) *fuliginosus*. (iii, v, viii, ix, x.)

M. lugens Grav. In company with *A.* (*D.*) *fuliginosus*; very scarce. (x.)

M. laticollis Märk. Abundant in company with *A.* (*D.*) *fuliginosus*. (v, viii, ix, x.)

Drusilla canaliculata F. In nest of *A.* (*D.*) *brunneus*, in company with *Myrmica ruginodis*, in moss with *M. laevinodis* and *A.* (*C.*) *flavus*; not uncommon. (v, vi, viii, ix, x, xii.)

Callicerus rigidicornis Er. With *A.* (*D.*) *brunneus* in a mole's nest, and on muddy bank of stream; scarce. (iv, viii.)

Thamiaraea cinnamomea Grav. Not uncommon at *Cossus* trees, and in *Cossus* frass. (v, vi, viii, ix.)

T. hospita Märk. In the same situations as the above, and equally common. (v, vi, viii, ix.)

Notothecta flavipes Grav. Abundant in nests of *Formica rufa.* (iii, v, ix, x.)

N. confusa Märk. In company with *A. (D.) fuliginosus*; not uncommon. (v, ix, x.)

N. anceps Er. Common in nests of *Formica rufa.* (iii, v, ix, x.)

Alianta incana Er. In swan's nest, and by sweeping Water Mint (*Mentha hirsuta*); scarce. (vi, viii.)

Atheta longicollis Muls. On mud round pond, and sides of sma. stream; scarce. (v, vii.)

A. pavens Er. In flood-refuse; scarce. (v.)

A. eichoffi Scriba. By sweeping rushes; scarce. (iv.)

A. gregaria Er. On mud round pond, and by sweeping; not common. (vi, vii.)

A. luteipes Er. In moss in willow-swamp; not common. (v, vi.)

A. luridipennis Mann. In manure-heap, and on mud round pond; not common. (v, vi.)

A. gyllenhali Thoms. In moss, fungi, and by evening sweeping; not common. (iv, viii.)

A. hygrotopora Kr. In swan's nest; rare. (vi.)

A. elongatula Grav. Abundant on mud round pond, in *Sphagnum* moss in willow-swamp, moorhen's nest, and fungi, by sweeping, etc.; very common. (iv, v, vi, vii, viii, ix.)

A. obtusangula Joy. In frass at *Cossus* tree; very scarce. (ix.)

A. vaga Heer. On banks of stream, in fungi, in moss in willow-swamp, etc.; not common. (vii, viii, ix.)

A. tomlini Joy. In moss in willow-swamp; scarce. (iv, ix.)

A. cambricina Keys. In moss; and in some numbers in moss in willow-swamp. (iv, v, viii, ix, x.)

A. malleus Joy. On bank of pond, in moss in willow-swamp, and by sweeping reeds, etc.; not common. (v, vi, vii, ix.)

A. nitidula Kr. In some numbers in company with *A. (D.) brunneus.* (vi.)

A. oblonga Er. On oak logs; scarce. (iv.)

A. silvicola Fuss. In 'Variable Polystictus' (*Polystictus versicolor*) and other fungi, and by sweeping; rare. (v, viii, ix.)

A. vicina Steph. Under bark, in wood-refuse, and in oak-frass with *A. (D.) brunneus*; not common. (iv, v, x.)

A. crassicornis Sharp. In frass with *A. (D.) brunneus,* at *Cossus* tree, and in dead leaves; scarce. (v.)

A. pagana Er. At roots of trees, and in old bird's nest; rare.

A. graminicola Grav. In moss in willow-swamp; rather common. (iv, v, vii, viii, ix.)

A. fungivora Th. In fungi, *Cossus* frass, and 'Sulphur Bracket' fungus (*Polyporus sulphureus*); not uncommon. (vii, ix, x, xi, xii.)

A. picipes Th. At roots of trees; rare. (vii.)

A. monticola Th. By evening sweeping; rare. (viii.)

A. nigella Er. In moss in willow-swamp, and abundant in swans' nests. (v, vi.)

A. aequata Er. Under bark of oak, beech, elm, etc., in 'Birch Bracket' fungus, in burrows of *Criocephalus polonicus* Mots., under dead jackdaw, etc.; very common. (iii, iv, v, vi, vii, viii, ix, x.)

A. linearis Grav. Under bark, in burrows of *Criocephalus polonicus,* and in nest of *Formica sanguinea*; not common. (v, vi, vii, viii.)

A. debilis Er. By evening sweeping; rare. (viii.)

A. fallaciosa Sharp. In fungi; scarce. (ix.)

A. circellaris Grav. (=*Sipalia circellaris*), abundant in moss in willow-swamp, on mud round pond, with *A.* (*D.*) *fuliginosus,* in 'Dryad's Saddle' fungus (*Polyporus squamosus*), 'Sulphur Bracket' fungus, other fungi, by sweeping, etc.; very common. (iv, v, vi, vii, ix, x, xi, xii.)

A. immersa Er. (=*Dadobia immersa*), under beech bark, in burrows of *Pityogenes bidentatus,* and by sweeping; not common. (v, vii, viii.)

A. cuspidata Er. (=*Thectura cuspidata*), under oak, beech, spruce and Scots pine bark, in birch bracket, etc.; not uncommon. (iii, v, vi, vii, viii, ix, x.)

A. vilis Er. At roots of tree in damp place; scarce. (viii.)

A. laticeps Th. In moss in willow-swamp; rare. (x.)

A. rigua Williams. By sweeping; rare. (viii.)

A. analis Grav. (=*Amischa analis*), common in *Formica rufa* nests, also with *A.* (*D.*) *brunneus, A.* (*C.*) *flavus,* and *A.* (*D.*) *niger,* at *Cossus* tree, in moss in willow-swamp, roots of grass, by evening sweeping, etc.; very common. (ii, iii, iv, v, vi, vii, viii, ix, x, xi.)

A. major Sharp (=*Amischa major*). In moss in willow-swamp; very scarce. (ix.)

A. decipiens Sharp (=*Amischa decipiens*). By evening sweeping, in moss in willow-swamp, in straw, cut bracken, and in dead jackdaw; not common. (iv, v, viii, ix, x.)

A. soror Kr. In moss; scarce. (vi.)

(*To be continued.*)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

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A. cavifrons Sharp (=*Amischa cavifrons*). In moss in willow-swamp, and in frass of old ash tree; scarce. (v, vi, ix.)

A. exilis Er. (=*Meotica exilis*). In swan's nest, and fishing in willow-swamp; scarce. (v, vi.)

A. exillima Sharp (=*Meotica exillima*). In damp spot, in straw and in *Sphagnum*; scarce. (vii, ix.)

A. depressa Gyll. By sweeping; scarce. (vi.)

A. aquatica Th. In 'Dryad's Saddle' fungus, 'Oyster' fungus (*Pleurotus ulmarius*), and other fungi, in cut grass, at exuding sap, and by sweeping; very common. (v, vi, vii, viii, ix, x, xi.)

A. pertyi Heer (*aeneicollis* Sharp). In fungi, and fungus dumps; not common. (vi, vii, x.)

A. castanoptera Mann. (*xanthoptera* Steph). In the 'Oyster' fungus (*Pleurotus ostreatus*), and other fungi, in hawk's nest, by sweeping, etc.; common. (v, vi, vii, viii, ix, x.)

A. euryptera Steph. In fungus dump, and in numbers at Cossus tree; not uncommon. (v, vi, viii, ix.)

A. nidicola J. P. Johansen. In hawks', crows' and magpies' nests; abundant. (vii, viii, ix, x.) This species was added to the British list by me from Windsor Forest.

A. trinotata Kr. At roots of trees, in manure-heap, deer's dung, fungi, Cossus tree, crows' nests, on bones, dead squirrel, etc.; very common. (iii, iv, v, vi, vii, viii, ix, x, xi.)

A. triangulum Kr. Sweeping, and under dead jackdaw; not common. (vi.)

A. inoptata Sharp. In many species of fungi, manure-heaps, hornets' comb, at exuding sap, on bones, in swans' nests, etc.; very abundant. (v, vi, vii, viii, ix, x, xi.)

A. reperta Sharp. In hawk's nest, fungi, on mud round pond, etc.; not uncommon. (vii, viii, ix, x.)

A. ignobilis Sharp. In fungi; scarce. (vi, xi.)

A. nitidicollis Fair. In some numbers in decaying fungi, on old bones, at exuding sap, and Cossus trees; not uncommon. (iv, vi, viii, ix, x, xi.)

A. nigritula Gr. (*boletobia* Fowl.). In hawk's nest, and cut grass; scarce. (vii, ix.)

A. liturata Steph. In various fungi; scarce. (vii, ix.)

A. coriaria Kr. In fungi, cut grass, under bark, and haystack bottoms, at Cossus tree, etc.; not uncommon. (v, vi, viii, ix, x.)

A. sodalis Er. In *Formica rufa* nests, also in company with *A.* (*D.*) *fuliginosus*, *A.* (*D.*) *brunneus*, and *A.* (*D.*) *niger*; in fungi, fern-refuse, on bones, and by sweeping; not uncommon. (iii. v, vi, viii, ix, x, xi.)

A. pallidicornis Th. About a dozen specimens of this rare species have been found in various fungi. (v, ix, x.)

A. clancula Er. In moorhen's nest, moss, and on muddy banks of stream; rare. (vii, viii.)

A. gagatina Baudi. In cut grass, fungi, hawk's nest, swan's nest, at Cossus tree, in dead jackdaw, and by sweeping; common. (v, vi, viii, ix, x, xi.)

A. divisa Märk. 'In fungi' (Blatch, 1887). In fungi and on bones; scarce. (vii, ix, x, xi.)

A. nigricornis Th. In hawks', crows', jackdaws', and other birds' nests; in fungi, manure-heaps, on bones, and at Cossus tree, etc.; very common. (i, ii, iii, v, vi, vii, viii, ix, x, xi.)

A. angusticollis Th. (*ravilla* Fowler). In fungi, in moss in willow-swamp, and on bones. (v, vi, vii, viii, ix, x.)

A. palustris Kies. In rejectamenta from ferret's cage; in refuse under *A.* (*D.*) *fuliginosus* nest, and by evening sweeping; not common. (viii, ix.)

A. corvina Th. In fungi, on bones, and in crow's nest; moderately common. (vii, ix, x, xi.)

A. puberula Sharp. In fungi, and in moss in willow-swamp; rare. (vi.)

A. dilaticornis Kr. Under beech bark; rare. (vii, viii.)

A. oblita Er. In various fungi, and in mud; rather scarce. (vi, vii, viii, ix, x.)

A. basicornis Rey. (*autumnalis* Fowler). Under beech bark, and in swan's nest; scarce. (v, vi.)

A. amicula Steph. (*sericea* Fowler). In fungi, cut grass, in dead rabbit and jackdaw, at Cossus tree, sweeping, etc.; common. (v, vi, vii, viii, ix, x.)

A. indubia Sharp. By sweeping; in magpie's nest, on bones; not uncommon on mud round pond. (vi, vii, viii.)

A. mortuorum Th. In manure-heap, fungus dump, deer's dung, on bones, and in dead rabbit; not common. (iii, vi, viii, ix.)

A. inquinula Er. In manure-heaps, and sifting refuse under *A.* (*D.*) *fuliginosus* nest; rare. (v, vi, x.)

A. zosterae Th. (*nigra* Fowler). In fungi, manure-heaps, cut grass, moss in willow-swamp, haystack bottoms, swans' nests, etc., etc.; very common. (iv, v, vi, vii, viii, ix, x.)

A. oloriphila Keys. A fair number of specimens was taken in a swan's nest. (vi.)

A. hodierna Sharp. A few specimens taken in a swan's nest. (vi.)

A. germana Sharp. In fungi, frass at roots of trees, on bones, in swan's nest, under cut bracken, etc.; not common. (vi, vii, viii, ix, x, xi.)

A. celata Th. In fungi, cut grass, in moorhen's nest, refuse under *A.* (*D.*) *fuliginosus* nest, etc.; not common.. (v, vi, vii, ix.)

A. sordidula Er. In fungi and at exuding sap; rare. (viii, ix.)

A. canescens Sharp. In decaying fungi, in moss in willow-swamp, on bones, in dead squirrel, etc.; not common. (vi, vii, viii, ix, x.)

A. cauta Er. In decaying fungi, dead squirrel, on bones; rare. (vi, vii.)

A. ischnocera Th. On bones; scarce. (vii.)

A. nigripes Th. (*villosula* Fowler). In fungi; scarce. (vi, vii.)

A. setigera Sharp. By sweeping; scarce. (vi.)

A. laevana Muls. In hawk's nest, and by evening sweeping; rare. (vii.)

A. cinnamoptera Th. In moss in willow-swamp, in fungi, on bones, and in hawk's nest; rare. (vi, vii.)

A. atramentaria Gyll. On bones, in swan's nest, and by sweeping; scarce. (vi, vii.)

A. cadaverina Bris. In fungi, hay, cut grass, on dead squirrel; not uncommon on bones. (v, vii, viii, ix.)

A. marcida Er. In numbers in various species of fungi, by evening sweeping; common. (x, xi.)

A. intermedia Th. In fungi, at Cossus tree, on bones, and by evening sweeping; not common. (vii, ix, x.)

A. longicornis Gr. In fungi, flood-refuse, swan's nest, on bones, and by sweeping; common. (i, iv, vi, vii, ix, x.)

A. sordida Marsh. In cut grass, loose hay and straw, moss in willow-swamp, fungi, etc.; common. (v, vi, vii, viii, ix, x.)

A. aterrima Grav. In the same situations as the above and equally common. (iv, v, vi, vii, viii, ix, x.)

A. parva Sahlb. (nec *cauta* Er.). In fungus dump, and sifting refuse under *A.* (*D.*) *fuliginosus* nest; rare. (ix.)

A. pygmaea Grav. In swans' nests; common on mud at margin of stream. (iv, v, vi, viii.)

A. muscorum Bris. In manure-heaps, fungi, cut grass, moss in willow-swamp, and sifting refuse under *A.* (*D.*) *fuliginosus* nest; not uncommon. (v, vi, vii, viii, ix.)

A. parens Muls. & Rey. In fern-stack refuse; very scarce. (vi.)

A. laticollis Steph. In cut grass, hay, moss in willow-swamp, fungi, in hawk's nest, etc.; common. (vi, vii, viii, ix, x.)

A. subsinuata Er. In haystack bottom; rare. (xi.)

A. orbata Er. At roots of trees, moss in willow-swamp, by sweeping, etc.; rare. (iv, v, ix, x.)

A. fungi Grav. In moss, fungi, birds' nests, at Cossus tree, etc.; very common and abundant. (ii, iv, v, vi, viii, ix, x, xi.)

A. clientula Er. In similar situations as the above, but not so common. (v, vi, viii, ix, x, xi.)

A. orphana Er. In moss; scarce. (x.)

A. paradoxa Rey. In moles' nests, and deep down in badger's earth; rare. (ii, iii, iv, v.)

Gnypeta labilis Er. Abundant on mud round ponds. The Windsor specimens differ slightly from the typical form. (v, vi, vii, ix.)

Tachyusa constricta Er. In flood-refuse; scarce. (v.)

T. flavitarsis Sahlb. On muddy bank of stream, and on mud round pond; scarce. (v, vi.)

T. concolor Er. On mud round ponds; scarce. (vi, vii.)

Falagria sulcatula Grav. In cut grass, manure-heaps, etc.; common. (vi, ix.)

F. obscura Grav. In moss, straw, cut grass, with *A.* (*D.*) *fuliginosus*; not uncommon. (iv, v, ix.)

Autalia impressa Ol. In cut grass, on bones, and abundant in various species of fungi. (vi, vii, ix, x.)

A. rivularis Grav. At sap, on bones, in manure-heaps, cut grass, etc.; common. (v, vi, vii, ix.)

Encephalus complicans Westw. By sweeping; rare. (viii.)

Gyrophaena pulchella Heer. This rare species occurred in some numbers in the 'Sulphur Tuft' fungus (*Hypholoma fasciculare*) on the roots and stump of a large felled beech; September, 1928.

G. affinis Mann. Abundant in various species of fungi. (v, vi, vii, viii, ix, x.)

G. poweri Crotch. In 'Sulphur Tuft' fungus; scarce. (ix.)

G. gentilis Er. In 'Oyster' fungus (*Pleurotus ulmarius*), and other fungi, also by sweeping; not common. (v, viii, ix.)

G. nana Payk. In fungi; scarce. (v, vii.)

G. fasciata Marsh. In fungi; scarce. (viii, x.)

G. minima Er. In 'Sulphur Tuft,' 'Honey Coloured Toadstool' (*Armillaria mellea*), and other fungi; common. (vi, vii, ix.)

G. laevipennis Kr. In many species of fungi; common. (vi, vii, viii, ix, x.)

G. bihamata Th. In various fungi; abundant in fungi under moss in willow-swamp. (viii, ix.)

G. lucidula Er. In some numbers in *Lentinus tigrinus* on willow stumps in willow-swamp. (v.)

G. convexicollis Joy. In some numbers in company with the above. (v, ix.)

G. strictula Er. Usually in *Daedalea quercina,* also in *Polystictus versicolor,* etc.; common. (v, vii, viii, ix.)

Agaricochara laevicollis Kr. In *Trametes rubescens,* 'Birch Bracket,' and other fungi; not uncommon. (ix, x.)

Placusa pumilio Grav. 'Under bark' (Blatch, 1887). On sappy oak stumps, under beech and oak bark; not uncommon. (iv, v, vi, viii, x.)

P. complanata Er. In frass at roots of trees, and under bark of Scots pine poles; rare. (viii, xi.)

P. infima Er. Under oak and elm bark, at Cossus trees, by beating faggots in willow-swamp, in fresh sawdust, etc.; common. (v, vi, vii, viii, ix, x, xi.)

P. denticulata Sharp. Under beech bark, on felled oak, and at Cossus tree; rare. (vii, ix.)

Homalota plana Gyll. (=*Epipeda plana* Fowler). Under bark of beech, elm, Scots pine, etc.; common. (iii, iv, vii, viii, ix, x.)

H. donisthorpei Allen. One specimen under beech bark, 1936 (Allen).

Euryusa optabilis Heer. 'In rotten beech' (Chitty, one specimen, 1896). This species occurs, at times in numbers, in company with the ant *A.* (*D.*) *brunneus*; once with *A.* (*D.*) *niger.* (i, ii, vi, vii, viii, ix, x.)

E. sinuata Er. One specimen under bark with *A.* (*D.*) *brunneus* (Joy, 1923). This species also occurs in considerable numbers in company with *A.* (*D.*) *brunneus.* (i, ii, iv, v, vi, vii, viii, ix, x.)

Tachyusida gracilis Er. Miss Kirk and I took nine specimens in a nest of *A.* (*D.*) *brunneus* in an old dead oak (x.26). This is the only British record.

Leptusa fumida Er. Very common under bark, in dry fungus, in frass of *Pissodes notatus,* in 'Sulphur Bracket' fungus (*Polyporus sulphureus*), and other fungi; with *A.* (*D.*) *brunneus,* etc.; abundant. (iii, v, vi, vii, viii, ix, x, xi.)

Sipalia ruficollis Er. Under bark, and by sweeping under firs; not common. (vii, ix.)

(*To be continued.*)

(*Continued from p.* 77.)

Bolitochara lucida Grav. In various species of fungi on trees and stumps; not uncommon. (v, vi, vii, viii, ix, x.)

B. reyi Sharp. In September, 1928, I took a single specimen of this species, new to Britain, in a fungus dump.

B. bella Märk. In *Pleurotus ulmarius*, *Collybia fuscipes*, and other fungi; not common. (v, viii.)

Hygronoma dimidiata Grav. By sweeping reeds, and in willow-swamp; not uncommon. (v, vi, ix, x.)

Oligota inflata Mann. In haystack bottoms, in manure-heaps, fern stacks, in willow-swamp, etc.; common. (vi, viii, ix, x, xi.)

O. parva Kr. In cut grass, in moss in willow-swamp, at roots of elm trees, etc.; not common. (iv, vi, ix, xii.)

O. pusillima Grav. In fern-refuse, cut grass, moss in willow-swamp, etc.; not uncommon. (vi, ix, xii.)

O. atomaria Er. In straw; scarce. (vii.)

O. punctulata Heer. Several in a bird's nest. (vi.)

O. granaria Er. One specimen was taken by evening sweeping (ix.26) far from any buildings. Its proper habitat is in cellars, where it feeds on the black mould (*Mucedo cellaris*) growing on old walls.

O. flavicornis Lac. In flood-refuse; very scarce. (xii.)

Myllaena dubia Grav. In swans' and moorhens' nests, in reed-refuse, etc.; not uncommon. (v, vi, viii, ix.)

M. intermedia Er. In moorhen's nest, in *Sphagnum*, and dragging sides of small stream; not common. (v, vii.)

M. minuta Grav. In moss in willow-swamp; scarce. (ix.)

M. brevicornis Matth. In flood-refuse, in moss in ditch and willow-swamp, in *Sphagnum*, etc.; not uncommon. (vi, vii, viii.)

M. gracilicornis Fairm. In *Sphagnum*; rare. (vi.)

Gymnusa brevicollis Payk. Running in *Sphagnum* swamp; scarce. (viii.)

Deinopsis erosa Steph. On banks of pond; scarce. (vi.)

Hypocyptus longicornis Payk. Abundant in sap-soaked earth, in hay, straw, fungi, flood-refuse, etc.; also by beating hawthorn; common. (iv, vi, viii, ix, xi, xii.)

H. laeviusculus Mann. Two specimens in a jackdaw's nest in a fallen beech. (xi.28.)

H. seminulum Er. By sweeping in damp spot; scarce. (vii.)

H. punctum Mots. In cut grass; scarce. (x.)

H. apicalis Bris. Under bark of felled beech; scarce. (viii.)

H. discoideus Er. Abundant by evening sweeping in plantations. (vii, viii.)

Conosoma littoreum L. Under wood-stack and logs; not common. (v, vi.)

C. pubescens Grav. In cut grass, straw, under logs, with *A.* (*D.*) *fuliginosus*, etc.; rather common. (iv, v, vi, ix, x.)

C. immaculatum Steph. In stool of felled poplar, and at *Cossus* tree; scarce. (ix.)

C. pedicularium Grav. By beating faggots, and in moss in willow-swamp; scarce. (iv, v, x.)

C. lividum Er. By evening sweeping, and in some numbers under cut ferns. (vii, viii, ix, x.)

Tachyporus obtusus L. In flood-refuse, and in moss in willow-swamp; not uncommon. (i, v, vii, ix, xii.)

T. formosus Matth. By sweeping; not common. (viii.)

T. solutus Er. In loose hay, straw, in moss in willow-swamp, and by beating hawthorn blossoms; not uncommon. (iv, v, vi, vii, viii, x.)

T. pallidus Sharp. Not uncommon in moss in willow-swamp. (v, viii, x.)

T. chrysomelinus L. In cut grass, fern-refuse, moss in willow-swamp, etc.; very common. (v, viii, ix, x, xii.)

T. humerosus Er. In fungus, and by beating hawthorn blossoms; abundant in moss in willow-swamp. (v, vii, viii, ix, x, xi.)

T. hypnorum F. In flood-refuse, loose hay, in moss in willow-swamp, by beating dead pines, etc.; common. (v, ix, x, xii.)

T. pusillus Grav. In flood-refuse, and by sweeping; not common. (vii, x, xii.)

T. brunneus F. In loose hay, reed-refuse, in moss in willow-swamp, by beating hawthorn; not uncommon. (iv, v, vii, viii, xi.)

T. transversalis Grav. In moss in damp spot; very local and scarce. (iii, v.)

Cilea silphoides L. Abundant in cut grass, in frass, loose hay, etc. (vi, vii, viii, ix, x.)

Tachinus humeralis Grav. In fungi, *Cossus* frass, and on dead squirrel; common. (v, vi, x, xi.)

T. bipustulatus F. At *Cossus* trees; not uncommon. (vi, viii, ix.)

T. rufipes L. In fungi, cut grass, moles' nests, wild honey-bees' comb, at *Cossus* tree, by sweeping, etc.; very common. (vii, viii, ix.)

T. subterraneus L. In large vine-house; in fungi, moss, loose hay, etc.; very common. (x, xi, xii.)

T. subterraneus L. ab. *bicolor* Grav. In fungi and fern refuse; not common. (x, xi, xii.)

T. marginellus F. In cut grass, fungi, birds' nests, moorhen's nest, dead leaves, on bones, etc.; very common. (ii, iii, vi, vii, viii, ix, x.)

T. laticollis Grav. In damp vegetable refuse; once common in the 'Dryad's Saddle' fungus; local and rare as a rule. (vii, viii, ix.)

T. elongatus Gyll. 'Windsor' (Stephens, 1839). I took a single specimen in a sand-pit (27.v.27).

Megacronus cingulatus Mann. At roots of tree; very scarce. (viii.)

M. analis Payk. On mole-hill, and in grass-refuse; scarce. (iii, iv.)

Bolitobius lunulatus L. In cut grass and fungi; common. (v, vi, vii, viii, x.)

B. trinotatus F. Common in fungi. (x, xi.)

B. exoletus Er. With the preceding; common. (vii, viii, x, xi.)

B. pygmaeus F. Common in fungi, by evening sweeping, etc. (viii, ix, x.)

Mycetoporus lucidus Er. At roots of trees, and running on felled oak; scarce. (vi, viii.)

M. splendens Marsh. On the wing, and by beating sallows and alders; scarce. (vi, ix.)

M. punctus Gyll. By sweeping, and in swamp, also under bark; scarce. (v, vi, vii.)

M. brunneus Marsh. In sand-pits; frequently by sweeping in the evening. (iv, vi, vii, viii, ix, x.)

M. longulus Mann. By evening sweeping; scarce. (vii, viii.)

M. angularis Rey. By evening sweeping; scarce. (vi, viii.)

M. clavicornis Steph. In sand-pit; very rare. (iii.)

M. splendidus Grav. In fungi, dead leaves, reed-refuse, moss in willow-swamp, at *Cossus* tree, sweeping, etc.; common. (iii, iv, v, vii, viii, ix, x.)

Habrocerus capillaricornis Grav. In cut grass, dead leaves, under chips, and bark; not uncommon. (vi, ix.)

Heterothrops praevia Er. In loose hay; not common. (vii, xi.)

H. dissimilis Grav. In loose hay, straw, and haystack bottoms; much commoner than the above. A ♂ was taken on November 30th, 1927, in cop. with a ♀ *Quedius scintillans* Grav. (v, vii, xi.)

H. nigra Kr. Common in moles' nests; deep down in a badger's earth. (iii, v, vi.)

Velleius dilatatus F. A larva was taken in a small recently deserted hornet's nest in the base of a small tree. This shows that this fine beetle is an inhabitant of Windsor Forest. The larva is now in the British Museum collection of Coleopterous larvae.

Quedius infuscatus Er. The first British specimens taken by me in a bird's nest in an old elm, 17.i.28; scarce. Subsequently taken by Mr. Edmonds in some numbers in birds' nests at Totnes, Devon.

Q. ventralis Arag. In black wood-mould in hollow branches and trees; in frass in centre of ash tree with *A.* (*D.*) *brunneus*; at sap; under bark; and in owl's nest refuse. Some very fine large ♂♂ taken; but it is not common. (ii, iii, vii, viii, ix, x.)

Q. lateralis Grav. In fungus, moss, birds' nests, under wood-stacks, at bones, *Cossus* trees, etc.; common. (vi, vii, ix, x.)

Q. mesomelinus Marsh. Under bark, in fungi, on bones, at *Cossus* tree; by beating hawthorn blossoms, etc.; common. (v, vi, viii, ix, x.)

Q. maurus Sahlb. Under bark, in fungi, with *A.* (*D.*) *fuliginosus,* in badger's earth, by beating hawthorn blossoms; rarer than the preceding. (iii, iv, v, vi, viii, x, xi.)

Q. nigrocoeruleus Rey. In moles' nests; not common. (ii, iii.)

Q. puncticollis Th. In nest of *A.* (*D.*) *fuliginosus*; local and scarce. (x.)

Q. brevicornis Thoms. Not uncommon in various birds' nests; three in hawk's nest at the top of a very high Scots pine; some very fine large ♂♂ taken. (i, ii, vi, viii, ix, x.)

Q. talparum Deville. In moles' nests; not uncommon; four in a nest of *Bombus lapidarius.* (iii, v, vi, viii.)

Q. cruentus Ol. In wood-mould, fungi, loose hay, under bark, on dead birds, and by beating hawthorn blossoms; common. (v, vi, vii, viii, ix, x.)

Q. cruentus Ol., ab. *virens* Rott. In wood-stack and in rotten fungi; scarce. (vii, x.)

Q. aetiolicus Kr. In birds' nests, under bark, in fungi, at *Cossus* tree, and with *A.* (*D.*) *brunneus*; not uncommon. (vi, vii, viii, ix, x, xi, xii.)

Q. scitus Grav. In frass, under bark, and in company with *A.* (*D.*) *brunneus*; not common. (ii, v, vi, vii, viii, ix, xi.)

Q. cinctus Pk. In fungi, loose hay, frass, fern-stack refuse, moss in willow-swamp, etc.; common. (vi, ix, x, xi.)

Q. brevis Er. In nests of *Formica rufa,* and in company with *A.* (*D.*) *fuliginosus*; not uncommon. (iii, v, vi, viii, ix, x.)

Q. fuliginosus Grav. In sand-pit, loose hay, faggots and moss in willow-swamp, fungi, deer-dung, etc.; common. (v, ix, x.)

Q. tristis Grav. In cut grass, fungi, at roots of trees, etc.; common. (iv, viii, ix.)

Q. picipennis Payk. On grassy path; scarce. (ix.)

Q. picipennis Payk. ab. *molochinus* Grav. Under bark, among dead leaves, and in loose hay, etc.; not common. (viii, ix.)

Q. picipes Mann. In loose hay and moss; not very common. (ix, x.)

Q. nigriceps Kr. In sand-pit, hay, moss, etc.; not common. (viii, ix.)

Q. fumatus Steph. Under timber and in dead leaves; scarce. (ix.)

Q. maurorufus Grav. In dead leaves and wet moss; scarce. (iv, v.)

Q. obliteratus Er. At *Cossus* tree, and by evening sweeping; scarce. (v, ix.)

Q. nemoralis Baud. In refuse, dead leaves, etc.; scarce. (v, vii.)

Q. scintillans Grav. In loose hay, refuse in trees, and by sweeping; scarce. (vi, vii, xi.)

Q. rufipes Grav. In fungus, moss in willow-swamp, loose hay, reed-refuse, haystack bottoms, etc.; common. (iv, v, vii, ix, x, xi.)

Q. attenuatus Gyll. In moss in willow-swamp; scarce. (v.)

Q. semiaeneus Steph. In moss in willow-swamp; scarce. (vi.)

Q. schatzmayri Grid. In moss in willow-swamp and in fungi; scarce. (v, vi, vii, ix.)

Q. boops Grav. In loose hay, *Cossus* frass, and by sweeping; not uncommon. (vii, viii, ix.)

Creophilus maxillosus L. On bones; not common. (vi, ix.)

Leistotrophus nebulosus F. On bones, at sap, and common in fungi, especially putrid 'Dryad's Saddle.' (v, vii, viii, ix.)

L. murinus L. In cut grass, putrid fungi, and in dead jackdaw; not common. (v, viii.)

Staphylinus pubescens De G. On bones; very scarce. (viii.)

S. stercorarius Ol. On the wing, and on path; very scarce. (viii, ix.)

Ocypus olens Müll. The 'Devil's Coach-horse'; in cut grass, at roots of trees, and in sand-pit; not uncommon. (iv, v, vii, ix, x.)

O. aeneocephalus De G. In sand-pit, flood-refuse, turf, and loose hay; not very common. (viii, ix, x, xii.)

O. ater Grav. Under bark, on the wing, and several specimens reared from pupae taken in wood-mould. This species, which occurs more frequently on or near the coast, is not very uncommon here. (vii, viii.)

O. globulifer Fourc. Under bark, in reed-refuse, under logs, etc.; common. (v, vi, vii, viii, ix.)

O. compressus Mark. Under bark, at roots of trees, etc.; not uncommon. (vi, vii, viii, ix.)

Philonthus splendens F. In sand-pit, deer- and cow-dung, by sweeping, etc.; not uncommon. (iii, iv, v, viii, ix.)

P. intermedius Boisd. In cow-dung; scarce. (vii.)

P. laminatus Creutz. At *Cossus* tree, in cut grass, birds' nests, horse-dung, and by sweeping; not uncommon. (ii, vi, viii, ix.)

P. aeneus Rossi. At *Cossus* tree, in manure-heaps, dead rabbit and pigeon; abundant in decaying fungi. (v, vi, vii, viii, ix, x.)

P. proximus Kr. In manure-heap, hawk's nest, dead squirrel, and in fungi; not common. (vi, vii, viii.)

P. carbonarius Gyll. At *Cossus* tree, in cut grass; abundant in putrid fungi. (viii, ix.)

P. decorus Grav. At sap, under chips, in fungi, at roots of grass, etc.; not common. (iv, v, vi, ix.)

P. politus F. In cut hay, in turf, on mud round pond, and by sweeping, etc.; common. (iv, viii, ix.)

P. varius Gyll. In cut grass, loose straw, wet moss, at roots of aquatic plants, in fungi, and moorhen's nest, etc.; common. (vi, vii, viii, ix, x.)

P. marginatus F. In cut grass, fungi, on bones, and by sweeping; not uncommon. (vii, viii, ix.)

P. albipes Grav. In manure-heaps in some numbers, in fungi, cut grass, and swan's nest; not uncommon. (v, vi, ix.)

P. albipes Grav., ab. *alpinus* Epp. In manure-heaps in company with the typical form, but much less numerous. (v, vi.) This is the only recorded British locality.

P. umbratilis Grav. In moorhen's nest, and in some numbers in swans' nests; very local. (vi, vii, viii.)

P. cephalotes Grav. In dead squirrel, on bones, and in comb of wild honey-bee; not common. (vi, vii, viii.)

P. rectangulus Sharp. In September, 1936, it was found in plenty in heaps of decaying cut grass. I had worked heaps of cut grass in the same spot for a number of years, and it had never occurred before.

P. fimetarius Grav. In flood-refuse, manure-heaps, fungi, moss, *Sphagnum*, fern-stack refuse, etc.; very common. (i, v, vi, vii, viii, ix, x, xi.)

P. sordidus Grav. In fungi, cut grass, vegetable refuse, by sweeping, and beating *Clematis*; not common. (vi, vii, ix, x.)

P. fuscus Grav. Abundant in magpies', hawks', jackdaws' and other birds' nests. (i, ii, vii, viii, ix, xi.)

P. concinnus Grav. By sweeping; scarce. (vi.)

P. debilis Grav. In loose hay and haystack bottom, also in swan's nest; not common. (vi, x.)

P. sanguinolentus Grav. In cut grass, and in cow- and horse-dung; not common. (v, vi, viii.)

P. cruentatus Gmel. In manure-heap, cow-dung and in cut grass; not very common. (v, vi, vii.)

P. longicornis Steph. In manure-heap, cut grass, moss in willow-swamp, etc.; not very common. (v, vi, vii, ix.)

P. varians Payk. In fungi, manure-heaps, cow-dung, cut grass, etc.; common. (v, vii, viii, ix.)

P. varians Payk., ab. *unicolor* Steph. (*Quedius unicolor* Steph.). On bones, under horse-dung and in wild honey-bees' comb; scarce. (vii, viii.)

P. agilis Grav. In cut grass and cow-dung; scarce. (v, vi.)

P. ventralis Grav. In manure-heaps and by sweeping; abundant in cut grass. (v, vi, vii, ix, x.) A specimen swept up on July 9th, 1935, has only four punctures, instead of five, on each side of the thorax.

P. discoideus Grav. In manure-heaps and cut grass; common. (v, ix.) Some slightly coloured aberrations occur.

P. quisquiliarius Gyll. In *Sphagnum*, moss in willow-swamp; common at roots of aquatic plants and on mud round ponds. (v, vi, vii, viii, ix.) The aberration with red elytra (*dimidiatus* Er.) has not been found here.

P. splendidulus Grav. Under beech bark; scarce. (vi, viii.)

P. thermarum Aubé. In hot manure-heaps and cut grass; not common. (ix.)

P. nigrita Nord. In moss; scarce. (vi, vii.)

P. fumarius Grav. In moss in willow-swamp; scarce. (ix.)

P. micans Grav. Abundant by sifting swan's nest. (vi.)

Gabrius nigritulus Grav. In cut grass, moss in willow-swamp, on mud round pond, by sweeping, etc.; common. (iv, vi, vii, ix, x.)

G. stipes Sharp. In cut grass, fungi, *Cossus* frass, and by beating faggots; not uncommon. (v, vi, vii, viii, ix, x.)

G. velox Sharp. In moss in willow-swamp and in reed-refuse; very local. (v, ix, x.)

G. pennatus Sharp. In moss in willow-swamp and on mud round ponds; not uncommon. (v, vi, vii, viii, ix, x.)

G. trossulus Nord. In cut grass; scarce. (x.)

Actobius cinerascens Grav. In swans' and moorhens' nests, in moss; common in *Sphagnum*. (v, vi, vii, viii, x.)

A. villosulus Steph. On water-net after dragging large pond, and in *Sphagnum*; scarce. (iv, v.)

A. prolixus Er. Two specimens on mud round pond. (Allen, vi.)

Xantholinus glabratus Grav. In cut grass; scarce. (ix.)

X. punctulatus Payk. In flood-refuse, loose hay, manure-heaps, fungi, crow's nest, etc.; common. (i, iv, v, viii, ix, x, xi.)

X. ochraceus Gyll. On the wing; scarce. (v.)

X. atratus Grav. A few specimens in a nest of *Formica rufa*. (ix.)

X. glaber Nord. With *A.* (*D.*) *brunneus* in old ash tree, and in

owl's nest in old oak tree; scarce. (vi, viii.)

X. linearis Ol. In cut grass, hay, fungi, moss in willow-swamp, swan's nest; once in *Formica rufa* nest; common. (iii, iv, vi, viii, ix.)

X. longiventris Heer. In sand-pits, hay, flood-refuse, etc.; not as common as the above. (iv, vi, viii, x, xii.)

Leptacinus parumpunctatus Gyll. In manure-heap, cut grass, and fungus dump; not common. (v, ix.)

L. batychrus Gyll. In cut grass and hay-refuse; not common. (iv, v, ix, x.)

L. intermedius Donis. In some numbers in a haystack bottom. (viii, ix, x, xi.)

L. linearis Grav. In manure-heaps, cut grass, hay, and under bark of Scots pine; one in haystack bottom; common. (v, vi, viii, ix, x, xi.)

L. formicetorum Märk. Common in nests of *Formica rufa*; once in company with *A.* (*D.*) *brunneus*. (iii, v, ix, x.)

Baptolinus alternans Grav. Common under bark of various trees; once by beating hawthorn blossoms. (v, vi, viii, ix, x, xi.)

Othius fulvipennis F. On the wing, in sand-pits, reed-refuse, *Sphagnum*, at *Cossus* tree, etc.; not uncommon. (iii, iv, v, viii, ix.)

O. laeviusculus Steph. In cut grass, by evening sweeping, and in company with *A.* (*D.*) *fuliginosus*; not uncommon. (v, viii, ix.)

O. melanocephalus Grav. In moss, haystack bottoms, at roots of trees, and by sweeping; several with *A.* (*D.*) *fuliginosus*; not very common. (vi, viii, ix, x, xi.)

O. myrmecophilus Kies. In company with *A.* (*D.*) *brunneus*, *A.* (*D.*) *fuliginosus*, *A.* (*C.*) *flavus*, and *Formica rufa*; rather common. A specimen taken in a sand-pit had a chitinous spur on the abdomen; one specimen was taken in a puff-ball and another in a moorhen's nest. (v, viii, ix, x.)

Lathrobium elongatum L. In moorhen's nest, in reed-refuse, and in *Sphagnum*; not common. (v, vii, viii, x.)

L. elongatum L., ab. *fraudulentum* Ganglb. One specimen in a moorhen's nest. (vii.)

L. geminum Kr. In *Sphagnum*, moss in willow-swamp, on mud round ponds, etc.; common. (iv, v, vi, viii.)

L. fulvipenne Grav. At roots of grass, in flood-refuse, moss in willow-swamp, haystack bottoms, etc.; not uncommon. (iv, v, vi, vii, ix, xi.)

L. brunnipes F. In *Sphagnum*, moss in willow-swamp, cut grass, in moorhen's nest and in moles' nests; common. (iii, iv, v, vi, ix, x.)

L. longulum Grav. One on the surface of a pool. (iii.)

L. fovulum Steph. One in flood-refuse in stream. (iv.)

L. filiforme Grav. In some numbers in moss in willow-swamp. (iv, v, vi, vii, ix, x.)

L. terminatum Grav. At roots of grass, in *Sphagnum*, moss in willow-swamp, swan's nest, moorhen's nest, etc.; common. (iii, iv, v, vi, vii.)

L. multipunctum Grav. In sand-pit, in *Sphagnum*, on border of lake, and under stones; not common. (iv, vi, vii, ix.)

Achenium depressum Grav. At roots of elms; not common. (iv, v.)

Cryptobium glaberrimum Hbst. In wet moss; not common. (v.)

Stilicus rufipes Germ. In loose hay in ditch, by sifting reed-refuse, and in fungi; not common. (iii, v, viii.)

S. orbiculatus F. In straw-refuse; rather common in loose hay. (vi, ix, x, xi.)

S. affinis Er. In manure-heaps, cut grass, fungi, fern-stack refuse, etc.; common. (iv, v, vi, viii, ix, x, xi.)

Medon apicalis Kr. 'A single specimen in the wet rotten wood of a large beech stump in Windsor Great Park' (Champion and Walker, 4.iv.96). By sweeping, 5.viii.31.

M. propinquus Bris. At roots of trees, in loose hay, birds' nests, straw, haystack bottoms, and with *A.* (*D.*) *brunneus*; common. (ii, iv, v, vii, x, xi.)

M. melanocephalus F. In haystack bottom; scarce. (xi.)

M. obsoletus Nord. 'Taken in company with *M. apicalis* Kr.' (Walker and Champion, 4.iv.96). In wet fern-refuse, 4.ix.34.

Lithocharis ochraceus Grav. Common in cut grass and manure-heaps. (v, vi, vii, viii.)

Sunius diversus Aubé. In fern-refuse and by sweeping; not common. (ix, xi.)

S. angustatus Payk. By sweeping; commoner than the above. (vi, vii, viii, x.)

Evaesthetus ruficapillus Lac. In moss, and especially in *Sphagnum* in swamp; rather common. (v, vii, viii.)

Dianous coerulescens Gyll. Not uncommon in moss in a waterfall; very local. (vi.)

Stenus biguttatus L. On mud round pond; scarce. (iv.)

S. bipunctatus L. On mud round ponds; very local but in plenty where it occurs. (v, vi, vii.)

S. bimaculatus Gyll. At roots of trees, in moss, by beating faggots in willow-swamp, by sweeping in marsh, etc.; common. (v, viii, ix, x.)

S. juno F. In moss in willow-swamp, in swan's nest, on mud round ponds, and by sweeping in marsh; not uncommon. (iv, v, vi, ix.)

S. longitarsis Th. On mud round ponds; very local, but not uncommon where it occurs. (v, vi, vii.)

S. speculator Er. By sweeping reeds, in cut hay, fungus, refuse-dump, etc.; not common. (iv, v, vii, x, xi.)

S. providus Er. v. *rogeri* Kr. In cut grass, frass, dead leaves, faggots in willow-swamp, hay-refuse, by sweeping, etc.; common. (v, vi, vii, viii, ix, x.) One specimen taken at the roots of a plant in a dry stream was named *providus* Er. by the late Colonel J. Sainte Claire Deville; the puncturation is unlike any of my other specimens.

S. buphthalmus Grav. By sweeping reeds, in moss, damp refuse; abundant on mud round ponds. (iv, v, vi, vii, viii, ix.)

S. incrassatus Er. One on mud at edge of pond (Allen, v).

S. melanarius Steph. In *Sphagnum*; scarce. (v, vii.)

S. atratulus Er. By sweeping in marsh and in haystack bottom; scarce. (v, ix.)

S. canaliculatus Gyll. By sweeping; scarce. (ix.)

S. pusillus Er. In flood-refuse; not uncommon in moss in willow-swamp. (iii, iv, vii, viii, ix, x.)

S. exiguus Er. In moss in willow-swamp; not common. (ix.)

S. fuscipes Grav. In moss in willow-swamp; scarce. (x.)

S. declaratus Er. In moss in willow-swamp; not common. (v, ix.)

S. crassus Steph. In reed-refuse; scarce. (v.)

S. subdepressus Muls. In sand-pit; scarce. (v.)

S. carbonarius Gyll. In moss in willow-swamp, where it is not uncommon. (iv, v, vi, ix, x.)

S. argus Grav. With the preceding species; not uncommon. (iv, v, vi, ix, x.)

S. brunnipes Steph. In cut grass, loose hay, *Sphagnum*, moss in willow-swamp, by sweeping, etc.; common. (iv, v, vi, vii, viii, ix, x, xi.)

S. subaeneus Er. At roots of trees, by sweeping, and in nest of *Formica rufa*; not common. (v, vii, viii, x.)

S. ossium Steph. By sweeping, and in damp vegetable refuse, fungus dump, etc.; not common. (v, viii, x.)

S. fuscicornis Er. In fern-refuse; this woodland species is occasionally met with by sweeping under trees. (viii, ix, x, xi.)

S. impressus Germ. In flood-refuse, moss, and by evening sweeping; common. (iv, v, viii, ix, x.)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

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S. aerosus Er. In reed-refuse, moss, and by evening sweeping; once by beating hawthorn blossoms; not uncommon. (iv, v, ix, x.)

S. pallipes Grav. Not uncommon in moss in willow-swamp. (v, ix, x.)

S. flavipes Steph. In moss, by beating hawthorn blossoms; common by sweeping. (v, vii, viii, ix, x.)

S. pubescens Steph. By sweeping, and at roots of reeds; not uncommon. (iv, viii.)

S. binotatus Ljungh. In *Sphagnum*, and on mud round pond, by sweeping reeds, etc.; not uncommon. (iv, v, vii, viii, ix.)

S. pallitarsis Steph. By sweeping reeds and water-plants, in *Sphagnum*, and swan's nest; common. (v, vi, vii, viii, ix.)

S. niveus Fauv. By sweeping *Carex* in *Sphagnum* swamp, reeds and sedge round mere; very local. (vii, viii, ix.)

S. bifoveolatus Gyll. In moss in willow-swamp, by sweeping reeds, etc.; common. (v, vii, viii, x.)

S. nitidiusculus Steph. In *Sphagnum*, and by sweeping in damp places; not common. (v.)

S. picipes Steph. In cut grass; common by sweeping. (vii, viii, ix, x.) On one occasion several hundred specimens were taken with a single stroke of the net, while evening sweeping in a plantation.

S. cicindeloides Grav. On mud round ponds, in *Sphagnum*-swamp, in moorhen's nest, and by sweeping reeds, etc.; common. (iv, vi, vii, viii, ix.)

S. similis Hbst. By sweeping grass under fir trees, beating faggots, etc.; not common. (viii, ix.)

S. solutus Er. By sweeping reeds round pond; rare. (v.)

S. tarsalis Ljungh. In swan's nest, by sweeping rushes, etc.; not common. (vi, vii, ix.)

S. paganus Er. In cut grass, loose hay, and by sweeping; not common. (vi, viii, ix, xi.)

S. latifrons Er. On mud round pond, in moss in willow-swamp, swans' and moorhens' nests, and by sweeping; not uncommon. (vi, ix, x.)

S. fornicatus Steph. By sweeping round edges of pond; rare. (v.)

Oxyporus rufus L. A single specimen in a fungus (*Pholiota spectabilis*) on a beech tree, 26.vi.30.

Bledius longulus Er. By beating hawthorn-blossoms. (25.v.28.)

B. fracticornis Pk. Remains found in a bird's nest. (10.vii.29.)

B. femoralis Gyll. In damp sand near mere; very local. (iv.)

Platystethus arenarius Fourc. In badger's earth, deer-dung, cow-dung, fungus dump, in hole in topmost branch of an ash tree, and by evening sweeping; common. (iii, iv, v, vii, viii, ix.)

P. cornutus Gyll. Abundant on mud round ponds. (vi, vii.)

P. alutaceus Th. In sand-pit; scarce. (v.)

P. nitens Sahlb. On mud round pond; not common. (vii.)

Oxytelus rugosus Grav. In moss, cut grass, thrush's nest, on mud round pond, etc.; common. (iii, iv, v, vi, vii, viii, ix, x.)

O. rugosus Grav. var. *terrestris* Lac. In damp wood-mould, horse-dung, in sand-pit, by sweeping, and on mud round pond; not common. (v, vi, vii, ix.)

O. sculptus Grav. In manure-heap, cut grass, moss, by sweeping reeds, etc.; not common. (vi, viii, ix.)

O. laqueatus Marsh. In moss in willow-swamp, fungi, horse-dung, etc.; not common. (viii, ix, x.)

O. inustus Grav. In moss in willow-swamp, 'Dryad's Saddle' fungus (*Polyporus squamosus*), dead squirrel, badger's earth, by sweeping, and beating hawthorn; not common. (v, vi, vii, viii, x.)

O. sculpturatus Grav. In birds' nests, badger's earth, cut grass, fungi, straw-refuse, moss, decaying wood, and in some numbers by sweeping reeds; common. (iii, iv, v, vi, vii, ix, x.)

O. nitidulus Grav. In cut grass, bird's nest, moss in willow-swamp, and on mud round pond; not common. (iv, vii, ix, x.)

O. complanatus Er. In cut grass, fungi, damp straw, and moss in willow-swamp; not very common. (vi, vii, ix.)

O. tetracarinatus Block. In fungi, moss in willow-swamp, badger's earth, moorhen's nest; abundant in hawk's nest, deer-dung, and on bones; very common. (iii, iv, v, vi, vii, viii.)

Haploderus coelatus Grav. In moss in willow-swamp, deer-dung, in large vine house; abundant in fungus dump. (iii, iv, vii, viii, ix.)

Ancyrophorus aureus Fauv. In flood-refuse, and on mud on banks of stream; very local. (iv, v, vii, viii.)

Trogophloeus bilineatus Steph. On banks of ponds and streams, by sweeping reeds, etc.; rather common. (v, vi, vii, viii, x.)

T. rivularis Mots. In moss in willow-swamp, in *Sphagnum*, on mud round ponds and streams; rather common. (iv, v, vii, viii.)

T. elongatulus Er. By evening sweeping; common in moss in willow-swamp. (iv, v, ix, x.)

T. impressus Lac. On mud on banks of stream, in flood-refuse, and moss in willow-swamp; rare. (v, vii.)

T. corticinus Grav. In swans' nests, flood-refuse, and moss in willow-swamp; rather common. (v, vi, vii, viii, ix.)

T. pusillus Grav. In manure-heap and cut grass; common in haystack bottom. (vi, ix, x.)

Syntomium aeneum Müll. On pile of cut-up branches, and by sweeping; rather scarce. (vi, vii.)

Coprophilus striatulus F. In rotten wood of felled poplar, and on the wing; scarce. (iv, viii.)

Lesteva longelytrata Goeze. In moss in willow-swamp and in waterfall; once by beating hawthorn blossoms. On 30.iv.33 numbers were seen dancing up and down in a sort of 'marriage flight' over a pool; common. (iv, v, ix, x.)

L. longelytrata Goeze, ab. *maura* Er. At edges of stream and in company with the typical form on 30.iv.33; not common. (iv, x.)

L. pubescens Mann. In flood-refuse and on bank of stream; scarce. (iv, viii.)

L. heeri Fauv. (*sicula* Fowl.). In flood-refuse, in moss in willow-swamp, swan's nest, on banks of streams; not uncommon. (v, vi, vii, viii, x.)

Olophrum piceum Gyll. In sand-pits and in moss; not common. (iv, viii, ix, x.)

Lathrimaeum atrocephalum Gyll. In fungi, under dead leaves, and by sweeping; not uncommon. (iii, iv, x.)

L. unicolor Steph. In fungi, moss, by sweeping, and in hot-house; not uncommon. (x, xi.)

Philorinum sordidum Steph. By beating gorse and sweeping comfrey; scarce. (v, vi.)

Coryphium angusticolle Steph. Under beech bark and by dragging small stream; scarce. (iii, v.)

Homalium rivulare Payk. In fungus, moss in willow-swamp, jackdaw's nest, dead squirrel, loose hay, and under bark; very common. (iv, v, vi, vii, ix, x, xi.)

H. septentrionis Th. On bones; very scarce. (viii.)

H. allardi Fairm. On bones and at *Cossus* tree; scarce. (vi, viii.)

H. exiguum Gyll. In damp vegetable refuse; scarce. (viii.)

H. excavatum Steph. In fern-stack and hay-refuse, in fungi and by beating fir tops; common. (v, vi, viii, xi.)

H. caesum Grav. In cut grass, moss and faggots in willow-swamp, beating dead pines, etc.; not uncommon. (v, vi, ix, x.)

H. caesum Grav., ab. *tricolor* Rey. At roots of trees; scarce. (vii.)

H. pusillum Grav. Under oak and beech bark, and in fungus-dump; not uncommon. (vii, viii, x.)

H. punctipenne Th. In fungi, deer-dung, under oak and beech bark and abundant at *Cossus* tree; very common. (iv, v, vii, viii, ix, x, xii.)

H. rufipes Fourc. By beating hawthorn, cherry, crab-apple and Portugal laurel (*Prunus lusitanica*) blossoms; by sweeping sallow-bloom and in jackdaw's nest; common. (iv, v, vi, xi.))

H. nigrum Grav. In decaying fungi and by beating hawthorn blossoms; very scarce. (vi, x, xi.)

H. vile Er. In fungi, by beating hawthorn and Scots pine, and by sweeeping; common. (v, vi, x.)

H. vile Er., var. *heeri* Heer. By beating hawthorn; scarce. (v.)

H. brevicorne Er. On top bough of old ash tree; very scarce. (vi.)

H. iopterum Steph. In fungi, birds' nests, and by beating hawthorn; not uncommon. (v, ix, x, xi.)

H. planum Payk. At *Cossus* tree, in numbers in fresh oak sawdust, and under bark; common. (v, vii, viii, ix.)

H. concinnum Marsh. In fungi, hay- and straw-refuse, in hawk's and other birds' nests, and abundant in nest of Grey Squirrel; common. (iv, vi, vii, viii, ix, x, xi.)

H. striatum Grav. In fungi and by evening sweeping; common. (viii, ix, x.)

Hapalaraea pygmaea Gyll. By evening sweeping and in fungus-dumps; not uncommon. (ix, x.)

Anthobium ophthalmicum Payk. By beating hawthorn trees, sweeping thistles in flower, umbels, etc.; not uncommon. (vi, vii, viii.)

A. torquatum Marsh. By sweeping and beating hawthorn, *Syringa* and elder blossoms; common. (v, vi.)

A. sorbi Gyll. By beating laurel in flower; abundant but very local. (v.)

Proteinus ovalis Steph. In moss in willow-swamp, on dead squirrel and bones; abundant in fungi. (v, x, xi.)

P. brachypterus F. In birds' nests, loose hay, cut grass, moss in willow-swamp, by sweeping, and abundant in fungi. (ii, ix, x, xi.)

P. macropterus Gyll. In moss in willow-swamp; scarce. (v, ix.) In my experience this species never occurs in fungi.

P. atomarius Er. In much decayed fungi; not common. (ix, x.)

Megarthrus denticollis Beck. In moss in willow-swamp, cut grass, loose hay, etc.; not uncommon. (vii, viii, ix.)

M. affinis Müll. In loose hay; not common. (viii, ix.)

M. depressus Lac. In fungi, loose hay, cut grass, in old bones, etc.; common. (v, vi, viii, ix, xii.)

M. sinuatocollis Lac. Abundant in fungi, loose hay, etc. (vii, viii, ix.)

M. hemipterus Ill. In various putrid fungi, especially 'Poor Man's Beef' (*Fistulina hepatica*); but neither common nor abundant. (viii, ix.)

Phloeobium clypeatum Müll. In moss, on muddy banks of stream, and by evening sweeping; not common. (v, viii, ix.)

Phloeocharis subtilissima Mann. Under bark, in fungi, and occasionally in nests of *Formica rufa*; not common. (v, ix, x, xi.)

Prognatha quadricornis Lac. Under bark of many species of trees; common and widely distributed. (v, vi, viii, ix, x.)

LEPTINIDAE.

Leptinus testaceus Müll. In frass with *A.* (*D.*) *brunneus*, at roots of *Cossus* tree, in fox's earth, rabbit-burrows, moles' nests, and on bones; widely distributed but not abundant. (iii, vi, vii, viii, x, xi.) This species is parasitic on field-mice, etc., and is distantly related to the beetle *Platypsyllus castoris* Rich., parasitic on the beaver.

(*To be continued*)

(*Continued from p.* 125)

Silphidae.

Calyptomerus dubius Marsh. By beating thatch, in cut hay and frass from *D. brunneus* tree; scarce. (ix, xi, xii.)

Clambus punctulum Beck. In cut grass, moss in willow-swamp, fern-stack refuse, frass, roots of trees, and by sweeping; not common. (iv, v, vi, viii, ix.)

Agathidium nigripenne Kug. Under beech bark, in fungus on beech, and by evening sweeping; widely distributed and usually scarce. (v, vi, vii.)

A. atrum Payk. In fungus-dump, flood-refuse, and under bark; not common. (iv, x.)

A. seminulum L. In fungi, dead leaves, frass with *D. brunneus*, wood of hawthorn inhabited by *D. fuliginosus*, in hole in ground of old wasps' nest; not common. (v, vi, ix, x.)

A. badium Er. Under and by sifting frass from oak bark; scarce. (v.)

A. laevigatum Er. In rotten 'Tinder Bracket' (*Fomes fomentarius*); scarce. (ix.)

A. confusum Bris. One fine ♂ in 'Variable Polystictus' (*Polystictus versicolor*) on old beech stump. (vi.)

A. varians Beck. 'Under bark' (Blatch, x.1887).

Anisotoma humeralis Kug. In fungus on trees, especially *Reticularia lycoperdon*, and occasionally by sweeping; not uncommon. (v, vi, vii, viii, ix.)

A. orbicularis Hbst. In rotten beech wood, in fungus on beech, and by evening sweeping; scarce. (v, vi, viii.)

Liodes cinnamomea Panz. By evening sweeping under fir trees and in a mixed plantation; local and has not been taken since 1931. Once swept at 2.30 p.m. in October. (ix, x.)

L. anglica Rye. By evening sweeping; very scarce. (ix.)

L. lucens Fairm. By evening sweeping under fir trees; local; ♂ swept off sedge round mere at 4 p.m. in September and one swept at 2.30 p.m. in October. (ix, x.)

L. obesa Schmdt. Very local, but taken in some numbers by evening sweeping in a mixed plantation. (ix, x.)

L. litura Steph. By evening sweeping; scarce. (x.)

L. calcarata Er. By evening sweeping; common. (vii, viii, ix.)

L. calcarata Er. ab. *nigrescens* Fleischer. Occasionally swept in company with the typical form. (vi, vii, viii, ix.)

L. curta Fairm. By evening sweeping; local, but sometimes in numbers; sixteen specimens swept in one evening; two swept at midday in October, and several in early afternoon. (viii, ix, x.)

Colenis dentipes Gyll. By evening sweeping, but also on bones, dead bird, and under fungus; not uncommon. (v, vi, viii, ix.)

Agaricophagus cephalotes Schmidt. By evening sweeping under lime trees; very scarce. (viii.)

Necrophorus germanicus L. '"On the banks of the Thames above Windsor."—Dr. Leach' (Stephens, 1830). There are two specimens in the Stephensian collection in the Natural History Museum.

N. humator Goeze. Under dead birds and animals; very large specimens on old bones; abundant in combs from hornets' nest and wild honey-bees' nest. On September 24th, 1930, a small specimen was found dead in a pheasant's egg, only the head and thorax protruding, and in the egg, which was otherwise entire, was a small specimen of *N. mortuorum* F. One can only surmise that the larvae of these beetles had made an entrance into the egg when quite young, had completed their metamorphosis inside, and were then unable to escape. (viii, ix, x.)

N. mortuorum F. In dead animals and birds, decaying hornets' comb, and on bones, but more frequently in decaying fungi; common. (viii, ix, x.)

N. ruspator Er. In dead birds and on bones; common. (vii, viii, ix).

N. ruspator Er., ab. *microcephalus* Th. Occasionally found with the typical form. (viii, ix.)

N. interruptus Steph. In comb from wild honey-bees' nest; very scarce. (viii.)

N. vespillo L. Under dead pigeon; scarce. (vii.)

Silpha 4-punctata L. By beating birch, hawthorn, hawthorn blossoms, etc., by sweeping wild hyacinth, and on the wing; common. (v.)

S. thoracica L. In dead squirrel, under dead pigeon, on old bones, and in wild bees' comb, often in the 'Stink Horn' fungus (*Phallus impudicus*). I once took 32 in a single 'Stink Horn'; not uncommon. (iv, vi, vii, viii, ix.)

S. rugosa L. In dead birds, on old bones, etc.; common. (iii, v, vi, vii, viii.)

S. sinuata F. Under the same conditions as the above and often in company with it; equally common. (v, vii, viii.)

S. laevigata F. Under boards, etc.; rare. (vii.)

S. atrata L. Under stones, bark, and in moss; common. (iv, v, viii, ix, x.)

S. atrata L. ab. *brunnea* Hbst. In fungus, under bark, and by sweeping; not as common as the typical form. (iii, iv, vi, vii, ix.)

Choleva angustata F. In moles' nests and by sweeping; rare. (ii, iv, x.)

C. cisteloides Fröhl. By evening sweeping and on the wing; rare. (v, ix.)

C. glauca Britt. By sweeping; scarce. (ix.)

C. spadicea Sturm. One under a stone. (v.)

C. velox Spence. By evening sweeping; scarce. (ix.)

C. wilkini Spence. By evening sweeping and in moss in willow-swamp; scarce. (iv, ix.)

C. anisotomoides Spence. In dead leaves in hollow oak; scarce. (xi.)

C. fusca Panz. In hornets' nest; scarce. (xi.)

C. nigricans Spence. In dead birds, fungi, under faggots, etc.; not uncommon. (vi, ix, x, xi.)

C. coracina Kell. In dead birds; scarce. (vi.)

C. morio F. In fern-refuse; scarce. (xi.)

C. grandicollis Er. In fungi, dead bird, and by evening sweeping; not common. (ix, x.)

C. fuliginosus Er. In dead birds, fungi, on bones, and by sweeping; not common. (v, vi, x, xi.)

C. nigrita Er. In fungus, dead jackdaw, and by sifting swan's nest; not common. (vi, vii, ix.)

C. tristis Panz. In fungi, dead animals and birds, on bones, etc.; abundant. (iv, v, vi, ix, x.)

C. kirbyi Spence. In fungi, dead animals and birds, and by evening sweeping; not common. (v, ix, x, xi.)

C. chrysomeloides Panz. In dead birds and abundant in putrid fungi. (v, vi, x, xi, xii.)

C. fumata Spence. In fungi, dead squirrel, and abundant in hawk's nest. (vi, vii, viii, ix, x.)

C. watsoni Spence. In dead birds and animals, swan's nest, and fungi, also by evening sweeping; common. (vi, viii, ix, x, xi.)

C. colonoides Kr. Abundant in birds' nests. (i, ii, v, vii, viii, ix, x, xi.)

Catops sericeus F. In cut-grass and haystack-bottom; not common. (v, xi.)

C. sericatus Chaud. In haystack-bottom; scarce. (xi.)

Colon brunneum Latr. Not uncommon by evening sweeping. (viii, ix.)

C. latum Kr. Very scarce; one specimen taken by Miss F. J. Kirk resting on the brickwork under a bridge over a stream, 29.vi.31.

SCYDMAENIDAE.

Neuraphes elongatus Müll. In moss and grass-refuse; scarce. (v, viii.)

N. minutus Chaud. In frass under beech bark; scarce. (viii.)

Scydmaenus godarti Latr. Under bark in wood-mould, frass in company with *A.* (*D.*) *brunneus*; not common. (ii, viii, ix.)

S. scutellaris Müll. Under stone and in decayed wood (Allen); scarce. (iii, vi.)

S. collaris Müll. Occasionally in moss. (v, viii.)

S. exilis Er. Under oak bark with *A. brunneus*; not common. (iv, v.)

Euconnus pragensis Machul. (1923) (nec *claviger* Müll. Donisthorpe, Ent. Rec., 38, 1926, 150). Nine specimens of this fine addition to Britain were taken in a nest of *A.* (*D.*) *brunneus* in the centre of a felled oak in October, 1926, in company with *Tachyusida gracilis* Er., previously mentioned.

E. hirticollis Ill. Abundant in moss in willow-swamp. (v, vi, vii, ix.)

Eumicrus tarsatus Müll. In manure-heap, cut grass, fungi and by sweeping; not very common. (vi, viii, ix, x.)

E. rufus Müll. Under oak bark; very scarce. (vii.)

Euthia clavata Reitt. One specimen under bark of oak stump. (v.) (*A. A. Allen*).

E. schaumi Kies. In wood-mould in old ash tree in company with *A.* (*D.*) *brunneus* and *A.* (*C.*) *umbratus*; very scarce. (v.)

E. formicetorum Reitt. Twice in company with *A.* (*D.*) *brunneus*; very rare. (viii.)

Cephennium thoracicum Müll. In moss and by brushing in hollow beech, in *Formica rufa* nest; in some numbers with *A.* (*D.*) *fuliginosus* and in moss with *A.* (*C.*) *flavus*.

PSELAPHIDAE.

Pselaphus heisei Hbst. In flood-refuse; scarce. (v.)

P. dresdensis Hbst. Twice singly in moss; very rare. (iv, vi.)

Tychus niger Payk. In moss in willow-swamp, at roots of elm tree, and by sweeping; not uncommon. (iv, v, viii, ix, x.)

T. niger Payk. ab. *dichrous* Schmt.-Goebel. One ♂ in moss in willow-swamp. (ix.)

T. ibericus Motsch. A ♂, the only known British specimen, was taken in moss in a willow-swamp (20.v.33).

Bythinus puncticollis Denny. In grass and reed-refuse and in moss; not uncommon. (iii, v, viii.)

B. bulbifer Reich. In flood- and reed-refuse and in moss; not uncommon. (iii, iv, v, vii, ix.)

B. curtisi Denny. In rotten wood-mould and scrapings of oak, under oak bark, in moss, flood-refuse, and by sweeping; not uncommon. (v, vi, vii, viii, ix.)

Batrisodes venustus Reich. In some numbers in company with *A.* (*D.*) *brunneus*. (i, iii, v, vi, vii, viii, ix, x, xi.)

B. delaportei Aubé. This fine Myrmecophile is to be found in most nests of *A.* (*D.*) *brunneus* and sometimes occurs in considerable numbers. This is the only known locality for it in Britain. We first discovered it on June 14th, 1924. (i, ii, iii, v, vi, vii, viii, x, xi.)

B. adnexus Hampe. Very scarce in nests of *A.* (*D.*) *brunneus*. First taken on June 26th, 1924.

Rybaxis sanguinea L. In moss in willow-swamp and in *Sphagnum*; common. (v, vii, viii, ix, x.)

R. sanguinea L. ab. *nigripennis* Fowl. & Donis. In moss in willow-swamp; scarce. (v.)

R. sanguinea L. ab. *nigropygialis* Fairm. In *Sphagnum* in swamp; scarce. (vii.)

Bryaxis fossulata Reich. In sand-pit, *Sphagnum*, moss in willow-swamp, by sweeping, etc.; not uncommon. (v, vi, viii, ix.)

B. haematica Reich. In moss in willow-swamp; scarce. (vi.)

B. juncorum Leach. By sweeping and in cut grass; not common. (ix, x.)

Bibloporus bicolor Denny. Under bark of oak in *brunneus* nests; scarce. (v, x.)

Euplectus punctatus Muls. In wood-mould from *brunneus* nest in old ash tree; scarce. (vii.)

E. tomlini Joy. In small bird's nest in hole in beech tree and under bark; scarce. (viii, ix.)

E. karsteni Reich. In bird's nest, by sifting dead leaves, and in frass from *brunneus* nests; not uncommon. (ii, vi, viii, ix.)

E. nanus Reich. In cut grass, birds' nests, under bark, and in frass from *brunneus* nests; rather common. (ii, v, vi, vii, viii, ix, x.)

E. sanguineus Denny. In wood-mould from *brunneus* nest in ash tree and in haystack-bottom; scarce. (vi.)

E. piceus Mots. Under oak bark, in wood from *fuliginosus* nest, and in frass from *brunneus* nests; not uncommon. (ii, iii, iv, v, viii, ix.)

E. nubigena Reitt. In wood-frass from an old oak; very scarce. (vii.) The only other locality for this rare species in Britain is Sherwood Forest, where it was taken by the late W. G. Blatch. This should have been mentioned in the list in the Introduction.

E. nitidus Fairm. One in wood and frass from a very old decayed oak trunk, a second specimen in company with *brunneus* in felled oak. These are the only British specimens as yet. (v, vi.)

E. afer Reitt., var. *infirmis* Raffr. In wood-mould of ash tree; several times in abundance in frass with *brunneus*. This is the only known British locality. (vi, vii.)

TRICHOPTERYGIDAE.

Pteryx suturalis Heer. In plenty in nests of *Formica rufa*. (x.)

Ptinella denticollis Fairm. Under fungi on stump; scarce. (ix.)

P. aptera Guer. In frass of dead oak; scarce. (x.)

P. angustula Gill. Under bark of oak and beech and in frass; not uncommon. (ii, vi, vii.)

Trichopteryx thoracica Waltl. In grass, etc., and in packing from *A.* (*D.*) *fuliginosus* nest; not common. (iii, v.)

T. atomaria De G. In moss and in mole's nest; scarce. (iii, viii.)

T. fratercula Matth. Abundant by sifting swan's nest, in moorhen's nest, and common in moss in willow-swamp. (vi, vii, x.)

T. grandicollis Mann. In fungus-dump; scarce. (x.)

T. lata Mots. By evening sweeping and on the wing; common in moss. (v, viii, x.)

T. fascicularis Hbst. In fungus-dump, sawdust, cut grass, straw and loose hay; common. (vi, viii, ix, x.)

T. laetitia Matth. In fungus-dump and loose hay; common. (ix, x, xi.)

T. sericans Heer. In manure-heap; not common. (v, vi, vii.)

T. montandoni All. In swan's nest; in *Formica rufa* nests, in company with *A.* (*D.*) *fuliginosus*, and abundant in company with *A.* (*D.*) *brunneus*. (vi, vii, ix, x.)

Nephanes titan Newm. In cut grass; not uncommon, but local. (ix.)

Ptilium kunzei Heer. In swan's nest and by sifting refuse beneath *A.* (*D.*) *fuliginosus* nest; scarce. (vi, x.)

P. rugulosum All. Not uncommon by sifting refuse beneath *fuliginosus* nest. (ix, x.)

P. subvariolosum Britten MS. Very scarce in company with the above. (ix, x.)

P. spencei All. In fungus dump; scarce. (x.)

P. exaratum All. In cut grass; local and scarce. (vi.)

P. myrmecophilum All. 'In nest of *Formica rufa*' (Blatch, ix.87).

Ptenidium nitidum Heer. In damp wood-mould, fungus dump, cut grass, swan's nest, and refuse beneath *fuliginosus* nest; common. (v, viii, ix, x.)

P. laevigatum Gyll. In cut grass, on bone, and common in mole's nest. (iii, ix.)

P. pusillum Gyll. In damp wood-mould, fungus dumps, manure-heaps, and cut grass; not uncommon. (vi, viii, ix, x.)

P. kraatzii Matth. In company with *A.* (*D.*) *brunneus* on several occasions. (vii, viii, ix.)

P. turgidum Th. Generally with *A.* (*D.*) *brunneus*, one in small bird's nest in hole in beech tree; not common. (v, vii, ix, x.)

P. gressneri Er. Under bark of tree inhabited by *A.* (*D.*) *brunneus*; rare. (ix.)

ORTHOPERIDAE.

Orthoperus brunnipes Gyll. Two specimens were taken in *Polystictus versicolor.* (ix.35.)

O. mundus Matth. In 'Birch Bracket' and 'Sulphur Bracket' fungi, in 'Dryad's Saddle,' under oak bark; often abundant, many *in cop.* under beech bark. (v, vi, vii, viii, ix, x.)

Sericoderus lateralis Gyll. In fungi, cut grass, on bones, and by sweeping; abundant in fern-stack refuse and haystack bottom. (v, vi, viii, ix, xi.)

PHALACRIDAE.

Phalacrus corruscus Payk. By sweeping grass and sedge in *Sphagnum* swamp, etc.; often abundant. (vi, vii, viii, ix.)

P. hybridus Flach. By sweeping herbage; local. (vii, viii.)

P. caricis Sturm. Abundant by sweeping sedge. (v. vi.)

P. caricis Sturm. ab. *delabyi* Guil. In company with the typical form; rather scarce. (v, vi.)

Olibrus corticalis Panz. By sweeping, beating hawthorn blossoms, etc.; not uncommon. (v, vi, viii, ix, x.)

O. aeneus F. In flood-refuse in December, by sweeping and beating hawthorn; abundant on *Matricaria, Achillea,* etc. (iv, v, vii, viii, ix.)

Stilbus testaceus Panz. By beating *Clematis* and by sweeping; not common. (viii, ix.)

COCCINELLIDAE.

Hippodamia variegata Goeze. By sweeping rough herbage; local but not uncommon. (viii.)

Anisosticta 19-punctata L. Abundant by sweeping reeds, etc., in marshy places. (v, vi, viii.)

Adalia obliterata L. By evening sweeping, under spruce bark, and by beating spruce trees; not uncommon. (iii, iv, ix, x.)

A. obliterata L. ab. *livida* Dej. By beating spruce; not common. (iv, ix.)

A. obliterata L. ab. *4-punctata* Donis. In company with the above; scarce. (iv, ix.)

A. bipunctata L. By sweeping, beating, under bark, in 'Birch Bracket,' etc.; very common. (v, vi, vii, viii, x, xi, xii.)

Mysia oblongoguttata L. By beating young Scots pines, spruce, burnt pines, etc.; widely distributed, but not abundant. (v, viii.)

Anatis ocellata L. By beating Weymouth and Scots pines, spruce, hawthorn blossoms, sweeping, etc.; widely distributed and rather common. (v, vi, vii, ix, x.)

Coccinella 10-punctata L. By beating all kinds of trees and sweeping; abundant everywhere. (iv, v, vi, vii, viii, ix, x, xi.)

C. hieroglyphica L. By sweeping grass and heather, under fir trees, etc.; local but abundant. The following aberrations have been taken in Windsor Forest: ab. *donisthorpei* Leman, ab. *kirkae* Leman, ab. *lloydi* Leman, ab. *edwardsi* Leman, ab. *sicardi* Leman, ab. *5-punctata* Edwards, ab. *curva* Weise, ab. *brunnea* Weise, ab. *sinuosa* Marsh., ab. *flexuosa* F., ab. *septempunctata* Rye, ab. *panzeri* Leman, ab. *bistriverrucata* Haworth, ab. *margine-maculata* Brahm, ab. *lissensis* Everts, and ab. *areata* Panz.

C. 11-punctata L. By sweeping and beating; common and widely distributed. (v, vi, vii, viii, ix, x.)

C. 11-punctata L. ab. *janeae* Donis. By sweeping (v.vii.35).

C. 7-punctata L. In flood-refuse in December, by beating hawthorn and sweeping everywhere; abundant. (v, vi, viii, ix.)

C. distincta Fald. var. *labilis* Muls. On and about the nests of *Formica rufa*; very local but abundant where it occurs. (vii, ix.)

C. distincta Fald. var. *labilis* Muls. ab. *domiduca* Weise. In company with the above; scarce. (vii, ix.)

C. 14-pustulata L. 'I possess a pair captured near Windsor' (Stephens, 1831). There are two specimens in the Stephensian Collection.

Halyzia 14-guttata L. By beating hawthorn and blackthorn blossoms; common. (iv, v, vii.)

H. 18-guttata L. By sweeping, and beating hawthorn, pines, etc.; common. (v, x.)

H. conglobata L. By sweeping grass, heather, etc., and by beating hawthorn, birch, sallow, etc.; common. (v, vi, vii, viii, ix, x.)

H. 22-punctata L. By general sweeping; common. (v, vi, vii, viii, x.)

Micraspis sedecimpunctata L. By sweeping *Melilotus, Matricaria,* etc.; very local. (vi, vii.)

Hyperaspis reppensis Hbst. 'Found, though rarely, near Windsor' (Stephens, 1831). In moss; very local and scarce. (v.)

Scymnus nigrinus Kug. Local; by beating young Scots pines; abundant. (vii, viii, ix.)

S. pygmaeus Fourc. In sand-pit, on path, and by evening sweeping, etc.; not common. (v, viii.)

S. suturalis Thunb. By beating Scots pines, cut fir tops, and sweeping under fir trees; common. (v, viii, ix.)

S. scutellaris Muls. By sifting reed-refuse and by sweeping; not common. (iii, viii, ix.)

S. capitatus F. By brushing in hollow oak tree, beating maple tree, and by sweeping; not uncommon. (vi, vii, viii, ix, x.)

S. minimus Rossi. Two specimens swept off grass, one with dark-coloured legs and antennae; very scarce. (viii.)

Chilocorus similis Rossi. By sweeping and beating sallows; not uncommon. A larva taken by beating dead ash branches, 29.vii.31, pupated, and emerged 16.viii.31; not uncommon. (vii, viii, ix, x.)

C. bipustulatus L. By sweeping, beating hawthorn blossoms and sallows; common. (v, viii.)

Exochomus quadripustulatus L. In sand-pit, by beating Weymouth and Scots pines, spruce, etc., and by sweeping; common. (iv, v, vii, ix, x.)

E. auritus Scriba (*Chilocorus rufipes* Steph.). 'One was captured near Windsor in June, 1816' (Stephens, 1832). There is a specimen in the Stephensian Collection.

Rhizobius litura F. In hay-refuse, cut grass, moorhens' and swans' nests, by sweeping, etc.; very common. (vi, viii, ix, x.)

R. litura F. ab. *maura* O'Mahony. By sweeping; not common. (vi, ix.)

Coccidula rufa Hbst. In swans' and moorhens' nests, on mud round ponds, in reed-refuse, and by sweeping; very common. (iv, v, vi.)

C. scutellata Hbst. One by sweeping thistles far away from any water; subsequently by sweeping rushes, and in reed-refuse round lake; local and not common. (v, vi, ix.)

(*To be continued.*)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

(*Continued from p.* 176.)

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ENDOMYCHIDAE.

Symbiotes latus Redt. Under oak bark in company with *A.* (*D.*) *brunneus*, and in *brunneus* nest; scarce. (vi.) The late E. W. Janson (1859) recorded it under loose bark on an old tree inhabited by a strong colony of *Lasius flavus* (=*A.* (*C.*) *umbratus* Nyl.), moving about among the ants; and Redtenbacher (1858) writes: 'This species lives with ants.'

Mycetaea hirta Marsh. In straw, fungus, in cellar, Crown Estate Office workshops, by sweeping, and abundant in hay-refuse in deer-pens. (vi, vii, viii, ix, x.)

Endomychus coccineus L. Larvae in numbers under bark of large fallen beech tree on the fungus, *Auricularia mesenterica* Pers. (iii.1928), all pupated and became adults. Most of the imagos were put back on this tree. One specimen has the right middle- and hind-legs deformed with tarsi duplicated, tibiae thickened, etc., the thorax also being abnormal. Now in Coll. Brit. Mus. Subsequently larvae and adults in similar situations. (iii, v, vi, vii, ix, x.)

EROTYLIDAE.

Dacne humeralis F. Abundant in many species of fungi. (v, vi, vii, viii, ix, x.) One specimen was beaten off birch and a number were bred from larvae in 'Sulphur Bracket' fungus.

D. rufifrons F. In various species of fungi; common. (vi, vii, x.)

Triplax russica L. In fungi of various kinds, under decayed bark and on logs; sometimes in numbers. (vi, vii, viii, ix.)

T. rufipes F. 'Found near Windsor' (Stephens, 1830). There is a specimen labelled 'Windsor' in the Stephensian Collection.

T. melanocephalus Latr. (*ruficollis* Steph., *nigriceps* Lac.). 'It was taken, I believe, near Windsor' (Stephens, 1830). There is a specimen in the Stephensian Collection. Fowler gives *T. ruficollis* Steph. as a synonym of *T. lacordairei* Crotch, but this is incorrect, as the former has a red head and the latter a black one. Consequently Fowler's record for *T. lacordairei*, 'Windsor (Stephens),' does not hold good.

COLYDIIDAE.

Aglenus brunneus Gyll. Twice in straw-refuse; scarce. (v, vii.)

Aulonium trisulcum Geoff. In the borings of *Scolytus destructor* Ol. in elm bark. The larva preys on the brood of the *Scolytus*. Very scarce in Windsor Forest until the last two years, when it has occurred in large numbers in elm logs and branches infested by *S. destructor*.

Teredus nitidus F. This species had been recorded in this country from Sherwood Forest only, until we found it at Windsor. There is, however, a specimen in the National Collection of British Coleoptera in the Natural History Museum labelled 'Desvignes,' but without locality. It is very probable that this specimen came from Windsor, as the late T. Desvignes often collected there in the early half of last century. It occurs in old oaks infested by *Xestobium tessellatum* F., *Anobium domesticum* Fourc., *Ptilinus*

pectinicornis L., and *Dryocaetes villosus* F. We have also found it in the burrows of *Callidium variabile* L., in a felled chestnut tree, and under bark of various trees. It is, however, most abundant in company with the ant *A.* (*D.*) *brunneus*, in their cells and with their brood. The late Miss F. J. Kirk, who was constantly finding this beetle, once took 87 specimens at one time under these circumstances. Not uncommon, and widely distributed. (iv, v, vi, vii, viii.)

Ditoma crenata F. In 'Birch Bracket' fungus and *Hypoxylon fuscum*; under bark of oak, Scots pine, and especially beech; very common. (iii, v, vi, vii, viii, ix, x, xi.)

Synchita juglandis F. By evening sweeping, under beech bark, and once in some numbers under loose bark of an old beech tree; not common. (vii, viii, ix.)

Cicones variegatus Hellw. Several times in *Hypoxylon fuscum*; abundant by scraping the black fungoid growth, *Ustulina vulgaris*, from the inside of hollow beech trees, and sifting over paper; local. (vi, vii, viii, ix.)

Myrmechixenus vaporariorum Guér. Sometimes in profusion in manure-heaps and cut grass. (ix.)

Langelandia anophthalma Aubé. In roots of a fallen elm; very local, ii (Allen).

Cerylon histeroides F. Common under bark of beech and other trees. (v, vi, vii, viii, x.)

C. ferrugineum Steph. Under bark of oak and beech; not uncommon. (vi, viii.)

HISTERIDAE.

Hister unicolor L. In cut grass, rotten fungus, fungus-dump, and cow-dung; not common. (v, vi, vii, viii, ix.)

H. merdarius Hoff. In squirrel's nest, six in a bat's resting-place in a hole in a tree; not uncommon in rather foul wet birds' nests. (i, v, vi, viii, ix, x.)

H. cadaverinus Hoff. Under dead pigeon; abundant on old bones. (vi, vii, viii.)

H. succicola Th. In dead squirrel and birds, in cut grass and *Cossus* frass; common on old bones and in decaying fungi. (v, vi, vii, viii, ix.)

H. marginatus Er. In moles' nests; very local and not common. (iii.)

H. cadaverinus Ill. In remains of rabbit, deer-dung and fungi; not uncommon. (vi, viii, ix.)

H. 12-striatus Sch. In cow-dung and manure heaps; common in decayed cut grass. (iv, v, vi, ix.)

H. bimaculatus L. In company with the above; common. (v, vi, viii, ix.)

Carcinops 14-striatus Steph. In cut grass and haystack bottom, six in bird's nest in hole in tree; not common. (v, vii, x.)

C. minima Aubé. In straw-refuse; scarce. (iii.)

Paromalus flavicornis Hbst. Common under bark and in frass. (vi, vii, viii, ix, xi, xii.)

Dendrophilus punctatus Hbst. In loose hay, straw-refuse, in company with *A.* (*D.*) *brunneus*, in squirrels' nests, and in some numbers in birds' nests. (i, ii, vi, vii, viii, x, xi.)

D. pygmaeus L. 'In nest of *Formica rufa*' (Blatch, 1887). In nests of *F. rufa*; scarce. (v, x.)

Myrmetes piceus Payk. In nest of *F. rufa*; not common. (iii, v, ix, x.)

Gnathoncus nannetensis Mars. In fungi, bird's nest, on old bones, and dead bird; not uncommon. (vi, vii, viii, ix, x.)

G. punctulatus Th. On bones; not uncommon. Five specimens in a crow's nest cut down from the topmost branches of a very high elm. (vii, viii, x.)

G. nidicola Joy. Under dead pigeon and on bones; abundant in birds' nests. (vi, vii, viii, ix.)

G. buyssoni Auzat. The only recorded British specimen was taken by me in a hawk's nest from the top of a very high Scots pine, 5.vii.27.

Saprinus nitidulus Payk. On bones, in dead squirrel; abundant in dead birds. (v, vi, viii.)

S. aeneus F. One in dead jackdaw (v.35).

S. virescens Payk. One swept off grass stem (vi.33).

Teretrius picipes F. 'Old palings . . . Windsor' (Stephens, 1839).

Plegaderus dissectus Er. In frass and under bark of oak, beech, etc.; in numbers in the burrows of *Dorcus* in felled beech, and in old ash tree in company with *A.* (*D.*) *brunneus*; common and often abundant. (ii, vi, vii, viii, ix.)

Abraeus globosus Hoff. In frass under oak- and beech-bark; abundant in burrows of *Dorcus* in company with the above; in *Hypoxylon* fungus, and common in frass with *A.* (*D.*) *brunneus*; very common. (ii, vi, vii, viii, ix, xi.)

A. granulum Er. In wood-mould, frass, and in birds' nests; often in great abundance in frass with *A.* (*D.*) *brunneus*. (i, ii, x.)

Acritus nigricornis Hoff. In cut grass and by sweeping; scarce. (ix.)

Onthophilus striatus F. In fungus-dump and abundant in cow- and deer-dung. (iv, viii, ix.)

MICROPEPLIDAE.

Micropeplus porcatus Payk. In deer-pen and in moss in willow-swamp; scarce. (vi, ix.)

M. staphylinoides Marsh. By evening sweeping; scarce. (ix.)

M. margaritae Duv. By dragging sides of small stream, in loose hay, and common in fern-stack refuse. (v, vi, ix.)

M. tesserula Curt. A single specimen of this rare species was taken by sifting bits of burnt bark, cinders, etc., beneath a larch trunk where there had been a fire (18.ix.29).

NITULIDAE.

Brachypterus gravidus Ill. Sweeping reeds, skullcap (*Scutellaria galericulata*), harebells (*Campanula rotundifolia*), etc.; not uncommon. (vi, vii.) It is usually found elsewhere in Toadflax (*Linaria vulgaris*).

B. pubescens Er. By sweeping nettles, once by beating spruce; common. (v, vi, viii.)

B. urticae F. By sweeping nettles and thistles in flower; common. (vi, viii, ix.)

Cercus bipustulatus Payk. By beating faggots in willow-swamp; scarce. (v.)

C. rufilabris Latr. By sweeping in damp places, rushes, *Alisma*, etc.; very common. (vi, vii, viii.)

Epuraea decemguttata F. At *Cossus* trees; not uncommon. (vii, viii, ix.)

E. diffusa Bris. In company with the preceding, and equally common. (vii, viii, ix.)

E. aestiva L. By beating hawthorn, crab-apple, *Prunus* and sallow blossoms, in moles' nests, and in badger's earth, in 'Stinkhorn' fungus, and by sweeping; very common. (iv, v, vii, viii, ix.)

E. melina Er. By beating hawthorn, blackthorn, cherry and *Prunus* blossoms, in mole's nest, and by evening sweeping; not very common. (iv, v, viii.)

E. longula Er. By beating crab-apple and *Prunus* blossoms, under bark of oak logs, and by evening sweeping; scarce. (iv, ix.)

E. florea Er. By beating blossoms and by sweeping, in frass of elm; very common. (iv, v, viii, ix.)

E. deleta Er. By beating hawthorn blossom; scarce. (v.)

E. parvula Sturm. By evening sweeping; scarce. (viii.)

E. obsoleta F. By beating blossoms, at *Cossus* trees, under bark, in frass, under chips and in hay-refuse; very common. (iv, v, vi, vii, viii, ix, x, xi.)

E. pusilla Er. In *Cossus* frass and fungi, by sweeping thistles in flower and by evening sweeping, under oak- and pine-bark, on the wing over large felled Scots pines, and by beating burnt pines; not uncommon. (v, vi, vii, viii, ix.)

Omosiphora limbata Payk. In the fungus *Lentinus tigrinus* on willow-stumps; scarce. (v.)

Micrurula melanocephala Marsh. By beating hawthorn and laurels in flower, and by sweeping herbage; not common. (v, vii, viii.)

Nitidula bipustulata L. In dead birds and animals; common. (v, vii, x.)

N. quadrifasciata F. In dead pheasant; scarce. (v.)

N. rufipes L. On old bone, in dead squirrels and rabbits; abundant in dead pheasant. (v, vii.)

Soronia punctatissima Ill. Common at *Cossus* trees. (vii, viii, ix.)

S. grisea L. In company with the above; common. (v, vi, vii, viii, ix.)

Amphotis marginata F. In some numbers in the runs of *A.* (*D.*) *fuliginosus*. (v, ix.)

Omosita depressa L. In remains of rabbit, and not uncommon on bones. (vii, viii.)

O. colon L. In fungus dump and by sweeping; common in dead rabbits and pheasants. (v, vi, x.)

O. discoidea F. By beating hawthorn blossoms, in fungus dump, hawk's nest, dead squirrel; abundant on bones. (v, vi, vii, ix, x.)

Thalycra sericea Sturm. By evening sweeping; scarce. (viii, ix.)

Pocadius ferrugineus F. Abundant in *Lycoperdon bovista* (the Giant Puff-ball); also in *L. gemmatum, Polyporus squamosus* (the Dryad's Saddle), *P. dryadeus* (the Dryad) and other fungi. (v, vi, viii, ix.)

Pria dulcamarae Scop. By sweeping *Solanum Dulcamara* (Woody Nightshade); abundant. (vi, ix.)

Meligethes rufipes Gyll. By beating hawthorn, sweeping buttercups, etc.; common. (v, vi, viii.)

M. lumbaris Sturm. By beating hawthorn, sweeping ox-eye daisies, bluebells, etc.; common. (v, vi.)

M. aeneus F. By beating hawthorn and *Rhododendrons,* sweeping bluebells, *Matricaria,* etc.; very common. (iv, v, vi.)

M. viridescens F. Under similar conditions as the preceding; common. (v, vii, viii, ix.)

M. difficilis Heer. By sweeping *Matricaria, Cardamine pratensis* ('Milk Maids'), etc.; not common. (v, vii, ix.)

M. morosus Er. By sweeping in willow-swamp; scarce. (ix.)

M. ovatus Sturm. By beating gorse, *Spiraea,* etc., sweeping thistles in flower, *Lycopus europaeus* (Gipsy-wort), *Campanula rotundifolia* (harebells), etc.; not uncommon. (iv, vi, vii, viii, ix.) This is the only species of *Meligethes* that I have noticed feigning death. The specimens from the thistle flowers did so.

M. flavipes Sturm. By sweeping; scarce. (vii.)

M. picipes Sturm. In moss in willow-swamp, by beating blackthorn blossoms, and sweeping ox-eye daisies, etc.; not uncommon. (iv, v, vi.)

M. lugubris Sturm. By sweeping; scarce. (vii.)

M. obscurus Er. In sand-pit and haystack bottom; not uncommon by sweeping *Teucrium Scorodonia* (Wood-sage). (vii, viii, ix, x, xi.)

M. erythropus Gyll. By sweeping and beating various flowers and blossoms; very common. (v, vii, viii, ix.)

Cychramus luteus F. By beating hawthorn, *Rhododendron* and cherry-blossoms; common. (v, vi.)

C. fungicola Heer. In fungi and by sweeping; common. (viii, ix.)

Cryptarcha strigata F. At *Cossus* trees; common. (v, vi, vii, viii, ix.)

C. imperialis F. In company with the preceding; equally common. (v, viii, ix.)

Ips 4-guttatus F. At *Cossus* trees, sap, under spruce- and beech-bark, in *Fistulina hepatica* ('Poor Man's Beef') and *Polyporus sulphureus* ('Sulphur Bracket') fungi, by beating hawthorn and by evening sweeping; common. (iv, v, vii, viii, ix, x, xi.)

I. 4-punctata Hbst. At *Cossus* trees, under chips, on willows; abundant in fungi. (v, vi, viii, ix, x.)

I. 4-pustulata L. 'Windsor' (Stephens, 1830). This record may be in error for this northern species.

Pityophagus ferrugineus Shuck. In *Cossus*-frass, under bark of Scots pine, in burrows of *Hylastes ater,* in sand-pit; in numbers flying over some large felled Scots pines. (v, xi.)

Rhizophagus cribratus Gyll. By sweeping short grass in the evening; scarce. (vi.)

R. depressus F. In poplar tree, under bark of spruce and oak logs, in burrows of *Hylastes palliatus*, by beating *Prunus* blossoms, in sand-pit and by evening sweeping; not uncommon. (iii, iv, v, viii.)

R. perforatus Er. Under bark of beech and oak, in poplar, on logs, in fungi, by beating hawthorn blossom, and on the wing; not uncommon. (v, vi, viii.)

R. parallelocollis Gyll. In frass and under bark of oak logs; not common. (vi.)

R. ferrugineus Payk. In wood-mould and *Cossus* frass, under oak-, beech- and fir-bark, at sap, and flying over felled Scots pines; common. (v, vi, vii, viii, ix.)

R. oblongocollis Blatch. Under bark of oak logs; very scarce. (vi.) The only other locality for this beetle in Britain is Sherwood Forest, where it was taken by the late W. G. Blatch.

R. bipustulatus F. Under beech and oak bark, bred from an oak bough, and in *Polyporus betulinus* ('Birch Bracket'); common. (iii, iv, v, x, xi.)

R. bipustulatus F. ab. *gyllenhali* Th. Under bark in company with the typical form; not common. (iii, v, x.) Introduced as British from Windsor Forest in 1926.

R. politus Hellw. Under bark of oak logs; very scarce. (vi.)

MONOTOMIDAE.

Monotoma conicicollis Aubé. In nests of *Formica rufa*; often abundant. (iii, v, ix, x.)

M. formicetorum Th. In September, 1926, this beetle was abundant in one nest of *Formica rufa*. I have not been able to find it since.

M. brevicollis Aubé. Scarce in manure-heaps in May and June, 1927; common in cut grass in May, 1934. Several in dead jackdaw.

M. picipes Hbst. In cut hay and haystack bottoms, by evening sweeping; abundant in manure-heaps. (v, x, xi.)

M. rufa Redt. By sweeping, in cut grass and haystack bottom; common. (vi.)

M. longicollis Gyll. In bird's nest, cut grass and abundant in manure-heaps. (v, vi, vii.)

LATHRIDIIDAE.

Lathridius lardarius De G. By beating lime trees and hawthorn blossoms, cutting grass tufts, and by sweeping; not common. (iv, v, vii, viii.)

L. angulatus Humm. By sweeping, in fern-refuse, and in some numbers by beating faggots. (v, vii, viii, ix.)

Coninomus nodifer Westw. On stacks of wood, in hay, straw-

refuse, cut grass, dead squirrel, *Pleurotus ostreatus* (' Oyster Mushroom ') and by sweeping, etc.; abundant everywhere. (v, vi, vii, viii, ix, x.)

C. constrictus Gyll. Under beech bark, in company with *A. (D.) fuliginosus* and by sweeping; rare. (vi, vii, x.)

C. carinatus Gyll. On the wing; scarce. (v.)

Enicmus minutus L. Under bark, in birds' nests, manure-heaps, fungi, by beating fir tops and hawthorn blossoms, and by sweeping; very abundant and common. (ii, iv, v, vi, vii, viii, ix, x, xi.)

E. minutus L. ab. *minutissimus* Mots. In fungus-dump, fern-stack and straw-refuse, haystack bottoms, etc.; common. (iv, vi, vii, viii, ix.)

E. transversus Ol. In moss, by beating faggots, on stacks of wood and abundant in cut grass. (v, vi, vii, viii, ix, xi.)

E. histrio Joy. In flood-refuse and abundant in loose hay; local. (ix, xii.)

E. testaceus Steph. By beating oaks and lime trees and on wood-stacks; not common. (viii, ix.)

E. brevicornis Mann. On oak bough, and on the wing over stack of beech wood; scarce. (v, vii.)

Cartodere ruficollis Marsh. In hay- and straw-refuse and hay-stack bottoms; not very common. (vii, ix, x.)

C. elongata Curt. In loose hay, straw, fungi, and abundant under chips. (iv, v, vii, viii, ix.)

C. seperanda Reitt. In some numbers on dead jackdaw, and abundant on bones, put down as a trap, when rather dry and mouldy. (vi, vii, viii.)

Corticaria pubescens Gyll. In old bird's nest; scarce. (vii.)

C. denticulata Gyll. In moss in willow-swamp and not uncommon by sifting reed-refuse. (iii, vi.)

C. serrata Payk. In frass with *A. (D.) brunneus*; scarce. (vi.)

C. crenicollis Mann. On stack of cut-up beech-wood; scarce. (vi.)

C. longicollis Zett. Under poplar and beech bark and by evening sweeping; not common. (viii, ix.)

C. eppelsheimi Reitt. On oak bough and by evening sweeping; rare. (vii.)

C. corsica H. Bris. In papery wood dust scraped from dead oak bough and standing tree. One in company with *A. (D.) brunneus*; not common. (v, vi, vii.) This is the only British locality known for this beetle.

C. elongata Humm. In frass in company with *A. (D.) brunneus*, by beating faggots and lime trees, in dry fungus, loose hay, by

evening sweeping, and abundant in haystack bottom. (iv, vi, vii, viii, ix, xi.)

C. aequidentata Allen. By sweeping round timber in evening; very scarce (vii) (Allen).

C. fenestralis L. In cut grass, hay-refuse, dead jackdaw, under pine bark, and abundant in manure-heaps. (v, vi, vii, viii.)

Melanophthalma gibbosa Hbst. In swan's nest, by sweeping reeds, etc., beating lime trees, sallow and crab-apple blossoms, in fern-stack refuse, and abundant by beating the cottony seeds of sallows; common. (iv, v, vi, vii, viii, ix.)

M. transversalis Gyll. By beating old hawthorn trees; scarce. (xi.)

M. fuscula Humm. In wood-mould and frass, cut hay, moss in willow-swamp, birds' nests, fungi, and by beating blossoms; very common. (ii, iv, v, viii, x, xi, xii.)

(*To be continued.*)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

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(*Continued from p.* 246)

CUCUJIDAE.

Pediacus dermestoides F. At *Cossus* tree, by beating laurel in blossom; under bark of oak logs; common under beech-bark. (iv, v, vi, vii.)

Laemophloeus bimaculatus Payk. Not uncommon under bark of felled beech trees and beech logs; occasionally in some numbers. (vii, viii.)

L. duplicatus Waltl. Under bark of oak logs and on beech logs; decidedly rare. (vi, vii.)

L. ferrugineus Steph. Common under bark of beech, oak, pine, etc. (vi, vii, viii, ix.)

Psammoechus bipunctatus F. In reed-refuse; scarce. (v.)

Silvanus unidentatus F. Common under bark of oak, beech, fir, etc. (iii, vi, vii, viii, ix, xi.)

Cathartus advena Waltl. In the greatest profusion in a hay-stack bottom. (viii, ix, x.)

BYTURIDAE.

Byturus sambuci Scop. By beating hawthorn blossoms, scarce; in numbers by sweeping buttercups (*Ranunculus auricomus*). (v, vi.) There is considerable confusion in the synonymy of this and the next species. This is the one with large eyes.

B. tomentosus F. By beating hawthorn and cherry blossoms, sweeping umbels and beating blackberry and wild raspberry canes; very common. (v, vi, ix.)

CRYPTOPHAGIDAE.

Diphyllus lunatus F. In the fungus *Daldinia concentrica* on ash trees and stumps; not common. (v, vii.)

Diplocoelus fagi Chevr. In the fungus *Hypoxylon fuscum* on felled beech trees; once in 'Tinder Bracket'; not common. (vi, vii, viii, ix.)

Telmatophilus caricis Ol. By sweeping reeds, rushes, *Sparganium*, etc.; also by beating hawthorn, common. (iv, v, vi, vii.)

T. typhae Fall. In damp vegetable refuse; scarce. (viii.)

T. schönherri Gyll. Abundant by sifting swan's nest. The nest was almost entirely composed of *Typha latifolia* (Reed Mace). (vi.)

Antherophagus nigricornis F. By sweeping thistles and heather, and by beating hawthorn, honeysuckle and brambles in flower; common. (vii, viii, ix.)

A. pallens Gyll. By sweeping Comfrey and *Stachys,* and in nest of *Bombus lapidarius*; not common. (vi, viii.)

A. silaceus Hbst. By sweeping; scarce. (vii, viii.)

Cryptophagus lycoperdi Hbst. In sand-pit, hay-refuse, by sweeping, beating elder blossoms; plentiful in the 'Common Earth Ball' (*Scleroderma vulgare* Horner). (iv, vi, viii, ix, x.)

C. setulosus Sturm. By evening sweeping, in fungi, comb of wild honey-bee, in remains of a *Bombus* nest, and abundant in a nest of *Bombus lapidarius*. (vi, vii, viii, ix.)

C. pilosus Gyll. In hay, straw, cut grass, swan's nest, and frass from *A.* (*D.*) *brunneus* nest; common. (iv, vi, ix, x, xi, xii.)

C. punctipennis Bris. By evening sweeping and in haystack bottom; scarce. (ix, xi.)

C. ruficornis Steph. In some numbers in the fungus *Daldinia concentrica* on burnt birch trees. (vii, viii, ix.)

C. saginatus Sturm. By evening sweeping, at *Cossus* tree, in hornet's nest and in fungus (*Hypoxylon fuscum*) on beech; not uncommon. (vi, vii, viii, x, xi.)

(*To be continued*)

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(Continued from Vol. LXXIII, p. 274.)

Cryptophagus umbratus Er. In mole's nest, in badger's earth, loose hay, and oak frass with *A.* (*D.*) *brunneus*; not common. (i, iii, v, vii, xi.)

C. stramenti Donis. A fair number have been taken in hay- and straw-refuse in a deer-pen. (iv, v, vii.)

C. scanicus L. In sawdust and frass, in 'Sulphur Bracket'

fungus (*Polyporus sulphureus*), in hornets' and wasps' nests, by beating hawthorn blossoms, sweeping, and in numbers in dry dead squirrel; common. (iv, v, vi, ix, x, xi.)

C. scanicus L. ab. *patruelis* Sturm. Under the same conditions as the above, but much less common. (iv, vi, ix, x.)

C.? fuscicornis Sturm. A specimen taken in frass from the roots of an oak, 19.vi.24, agreed well with the tables and description of this species. I sent it to the late Colonel J. Sainte Claire Deville, but it was broken in the post.

C. dentatus Hbst. At sap, under bark, sweeping, beating faggots and sallow blossoms, in swan's nest, fern-stack refuse, etc.; very common. (v, vi, vii, ix, x, xi.)

C. dentatus Hbst., ab *major* Donis. In rotten agarics, 'Sulphur Bracket' fungus (*Polyporus sulphureus*), 'Dryad's Saddle' fungus (*Polyporus squamosus*), and in some numbers in 'Birch Bracket' fungus (*Polyporus betulinus*). (v, vi, vii, ix, x.)

C. cylindrus Hies. By beating burnt Scots pine; scarce. (viii.)

C. pallidulus Sturm. In fresh cut oak sawdust; rare. (ix.)

C. acutangulus Gyll. In hay, straw and in bird's nest; not common. (ii, iv, xi.)

C. cellaris Scop. In cellars of the Crown Estate Office and in frass of *A. brunneus* nest; scarce. (xi, xii.)

C. affinis Sturm. By sweeping and in fern-stack refuse; not common. (vi, viii.)

C. pubescens Sturm. In hay refuse, by beating lime trees and honeysuckle, by evening sweeping, and in wasps' nests in the ground; common. (vii, viii, ix, x.)

C. løvendali Gang. At *Cossus* tree, on bones, and in numbers with its larvae in hornets' nests and wasps' nests in trees. (vii, ix, x, xi.)

C. bicolor Sturm. In hay and straw in deer-pens; not uncommon. (iv, v, vii, viii, x.)

Micrambe vini Pz. By sweeping melilot and beating gorse and broom; common. (iv, v, vii.)

M. villosa Heer. By beating faggots and sweeping in willow-swamp, by beating the cottony catkins of sallows, and by evening sweeping under fir trees; common. (v, vi, viii, ix.)

Henoticus serratus Gyll. By evening sweeping, under beech bark, and in 'Sulphur Bracket'; not common. (v, vi, viii.)

Paramecosoma melanocephalum Hbst. In damp spots; scarce. (x.)

Caenoscelis pallida Woll. One by evening sweeping (Allen, ix).

Atomaria umbrina Er. In fungi on stumps and by beating faggots in willow-swamp; scarce. (v, vi, ix.)

A. linearis Steph. By beating hawthorn blossoms, fir-tops, in fern-stack refuse, and by evening sweeping; not common. (v, vi, viii.)

A. elongatula Er. By beating fir-tops; scarce. (v.)

A. badia Er. By beating fir-tops and by evening sweeping; scarce. (viii.)

A. pulchra Er. On stacks of wood, under bark of oak logs, and in some numbers in and about the borings of *A.* (*D.*) *brunneus.* (iv, v, vi, vii, viii.) This species has only been found in Windsor Forest, where it was discovered by us in 1930.

A. peltata Kr. On stack of beech logs; scarce. (iv.)

A. morio Kol. Two specimens, the only British examples, were taken by us in a jackdaw's nest in November, 1928.

A. fuscata Sch. In moss in willow-swamp and by sweeping; common. (iv, v, vi, vii, viii, ix.)

A. zetterstedti Zett. Taken in some numbers by beating the cottony catkins of sallow in willow-swamp; very local. (v.)

A. atra Hbst. By sweeping; not common. (viii, x.)

A. pusilla Payk. In straw-refuse, by beating faggots, and by evening sweeping; not uncommon. (vi, vii, viii.)

A. atricapilla Steph. In flood-refuse, moss in willow-swamp and fern-refuse; not very common. (vi, ix, xii.)

A. berolinensis Kr. In some numbers in moss in willow-swamp. (iv, v, vii.)

A. mesomelas Hbst. In swan's nest, moss in willow-swamp, grass round pond, and by sweeping reeds; not common. (iv, vi.)

A. apicalis Er. In manure-heaps, moss in willow-swamp, fungi; abundant in hawk's nest; common. (v, vi, vii, viii, ix, x, xii.)

A. analis Er. In moss in willow-swamp, in *Lycoperdon pyriforme,* and abundant in loose hay. (iv, ix.)

A. ruficornis Marsh. In fern-stack and straw refuse, swan's nest; abundant in cut grass and loose hay. (vi, vii, ix, x, xi, xii.)

Ephistemus gyrinoides Marsh. In manure-heap, cut grass and abundant in loose hay. (v, vi, vii, viii, ix, x.)

SCAPHIDIIDAE.

Scaphidium quadrimaculatum Ol. In fungus on old beech, and not uncommon under beech logs; one specimen by beating hawthorn blossoms. (v, vi, vii.)

Scaphisoma agaricinum L. In damp fungoid wood and bark, etc.; common. (v, vi, viii, ix, x.)

Mycetophagidae.

Typhaea fumata L. In swan's and moorhen's nests, sand-pit, by beating faggots, and abundant in haystack bottoms. (iv, vi, viii, xi.)

Triphyllus suturalis F. In 'Dryad's Saddle' fungus, 'Sulphur Bracket' fungus, etc.; abundant in heap of 'Stink Horn' fungi. (vii, viii, xi.)

T. punctatus F. Common in many species of fungi, especially *Fistulina hepatica*. (vii, viii, ix, x.)

Litargus bifasciatus F. In fungi—*Hypoxylon fuscum*, *Daldinia concentrica*, etc.; common under beech bark. (v, vi, vii, viii, ix, x.)

Mycetophagus quadripustulatus L. Very abundant in many species of fungi, especially Oyster fungus (*Pleurotus ostreatus*) on elms; once by beating hawthorn blossoms. (v, vi, vii, viii, ix, x, xi.)

M. quadripustulatus L. ab. *antemacularis* Torre. In Oyster fungus in company with the typical form; scarce. (x, xi.)

M. quadripustulatus L. ab. *ruficollis* Schilsky. In company with the above; scarce. (x, xi.)

M. piceus F. In many species of fungi; common. (v, vii, viii, ix, x.)

M. atomarius F. In fungi and under beech bark; not uncommon. (iii, v, vi, viii.)

M. multipunctatus Hellw. Common in various species of fungi, especially 'Dryad's Saddle.' (vi, vii, viii, ix.)

Dermestidae.

Dermestes vulpinus F. The late E. W. Janson found it in some numbers in Windsor Forest, crawling over an old oak (teste the late Oliver Janson). I swept a specimen off Melilot, 21.viii.36.

D. murinus L. On dead squirrels and abundant on dead crows. (v, vii, x.)

Attagenus pellio L. In cut grass; very scarce. (v.)

Megatoma undata Er. By beating hawthorn and crab-apple blossoms, on old oak, by sweeping, and bred out of 'Tinder Bracket'; rather uncommon. (v, vi, vii.)

Tiresias serra F. Larvae abundant all the year round in spiders' webs under oak bark. We have reared a number—a larva taken 2.iv.34, pupated 5.v.35, and emerged 19.v.35—by feeding them on dead flies. Adults have been taken by us crawling on an old oak, on a fence, in hollow tree, in the 'Dryad fungus,' and several still in their pupa cases under bark. (v, vi, vii.)

Hadrotoma nigripes F. 'Near Windsor' (Stephens, 1839).

Anthrenus varius F. Once by sweeping flowers (10.vii.34).

A. museorum L. On Umbelliferae. (vi, vii, viii.)

A. claviger Er. In company with the above, but more abundant. (vi, vii, viii.)

Trinodes hirtus F. Larvae and imagines in cobwebs under oak bark. We have reared a few from the larvae — a larva taken 28.ix.26, pupated 17.v.27, emerged 21.v.27 — by feeding them on dead flies. Imagines also taken on ledges in deer-pens, by sweeping in hollow trees, and by beating oak boughs; not uncommon. (v, vi, vii.)

BYRRHIDAE.

Byrrhus pilula L. In sand-pits, etc.; common. (iv, v.)

B. fasciatus F. In sand-pits; one by beating hawthorn blossoms; common. (v.)

B. dorsalis F. Not uncommon in sand-pits. (iv, v, viii.)

B. murinus F. In sand-pits; not as common as the three above species. (v.)

Cytilus varius F. In sand-pits, in damp places and in moss; not uncommon. (v.)

Simplocaria semistriata F. In moss, frequently by evening sweeping, and in numbers in a sand-pit; common. (v, ix, x, xi.)

Aspidiphorus orbiculatus Gyll. Frequently by evening sweeping, and in the fungus *Reticularia lycoperdon* on stumps; common. (vi, vii, viii, ix.)

PARNIDAE.

Limnius tuberculatus Müll. On weeds fished up from the bottom of the river at Windsor; rather common. (vii.)

Dryops luridus Er. (*Parnus prolifericornis* Fowler). In moss, in pond, and in *Sphagnum* pool; not abundant. (iv, vi, vii.)

HETEROCERIDAE.

Heterocerus marginatus F. In flood-refuse, on muddy banks of stream, and in mud round pond; fairly common. (iv, v, vi.)

H. laevigatus Panz. Common on mud round pond. (iv, vi.)

LUCANIDAE.

Lucanus cervus L. The 'Stag Beetle' is occasionally met with at roots of trees, on oaks, and on paths. In 1935 it was extremely abundant on a road near the Forest. (vi, vii.)

Dorcus parallelopipedus L. In abundance in all stages in ash, elm and beech trees. At *Cossus* tree and in *Cossus* frass. A very small specimen was reared 9.ii.28 from a larva taken in 1926. (i, ii, v, vi, vii, ix.)

Sinodendron cylindricum L. In rotten beech and on beech stump; decidedly scarce. (i, vi.)

SCARABAEIDAE.

Onthophagus fracticornis Payk. On the wing, in deer's and other dung; sometimes abundant. (v, viii.)

Aphodius erraticus L. On the wing and in dung; sometimes abundant in cow-dung. (v, vi, vii.)

A. subterraneus L. In manure-heap and cow-dung; not common. (v.)

A. fossor L. In horse-dung, deer-dung; abundant in cow-dung. (v, viii.)

A. haemorrhoidalis L. In cow-dung and on the wing; not uncommon. (v, vi, vii, ix.)

A. foetens F. In cut grass, deer-dung and by sweeping; not common. (viii, ix, x.)

A. fimetarius L. In cut grass, hay-refuse, deer-dung; abundant in cow-dung. (iv, ix, x.)

A. scybalarius F. In cut grass; scarce. (ix.)

A. ater De G. In flood-refuse, deer-dung and cow-dung; common. (iv, v, viii, xii.)

A. constans Dufts. In cow-dung; scarce. (iv.)

A. granarius L. On the wing, in reed-refuse, in cut grass, and cow-dung. One by beating hawthorn blossoms; common. (v, vi.)

A. sordidus F. In deer-dung; scarce. (ix.)

A. rufescens F. Common in deer-dung. (vii, viii, ix.)

A. putridus Sturm. By evening sweeping, in fungus-dump, and in deer-dung; not uncommon. (v, viii, ix.)

A. varians Dufts. (*bimaculatus* Steph.). 'Rare: the only indigenous specimens which I have seen are in the collection of the British Museum; they were taken near Windsor many years ago' (Stephens, 1830). There are two specimens in the drawer of doubtful British Coleoptera at the Museum.

A. tristis Panz. In dung; scarce. (v.)

A. pusillus Hbst. In deer-dung (Allen); scarce. (vi.)

A. 4-maculatus L. 'Near Windsor' (Stephens, 1830).

A. merdarius F. In deer-dung (Allen); scarce (vi.)

A. sticticus Panz. In deer-, horse- and cow-dung, on the wing, and by evening sweeping, one specimen under bark; common. (iv, v, vi, viii, ix, x.)

A. punctato-sulcatus Sturm. In cow-dung, by evening sweeping, and in some numbers on the wing. (v, x.)

A. prodromus Brahm. In sand-pit, deer-dung and on the wing; common. (ii, iii, iv, ix, x.)

A. contaminatus Hbst. In cut grass and on the wing; abundant in deer-dung.

A. obliteratus Panz. On the wing and in fungus dump; scarce. (ix, x.)

A. zenkeri Germ. Abundant at times in deer-dung; frequently by evening sweeping. (vii, viii, ix.)

A. rufipes L. In cut grass, horse-dung, deer-dung; common. (viii, ix, x.)

Oxyomus porcatus F. In flood-refuse and cut grass; not common. (v, vi.)

Geotrupes typhoeus L. In sand-pit, fungus-dump, in and under dung, often on grassy paths; common. (ii, iii, v, vi, x, xi.)

G. spiniger Marsh. In flood-refuse; once common under horse-dung. (i, ix.)

G. stercorarius L. In fungus-dump, cow-dung, deer-dung, on paths; commoner than the above. (iv, v, viii, ix, x.)

Trox scaber L. In wood-mould and frass in oaks and elms; common in birds' nests. (i, ii, vi, vii, viii.)

Hoplia philanthus Füss. On the wing; scarce. (vi.)

Serica brunnea L. In sand-pits and on road; not common. (vii, viii.)

Rhizotrogus solstitialis L. At foot of privet hedge, in lodge and on the wing at dusk; local but not uncommon. (vii.)

Melolontha vulgaris F. By beating hawthorn blossoms and general beating; sometimes in the greatest profusion on oak trees and on roads. (v, vi.)

Phyllopertha horticola L. By beating hawthorn, on the wing; abundant flying in lodge garden and settling on the grass. (v, vi.)

Oxythyrea stictica L. 'Several specimens of this insect were taken three or four years since near Windsor by Mr. J. R. Griesbach' (Stephens, 1830). There is a specimen in the Stephensian collection.

Cetonia aurata L. By beating hawthorn blossoms and rhododendrons, and on the wing; sometimes not uncommon flying round hawthorn trees in flower. (v, vi.)

(*To be continued.*)

(*Continued from p. 27*)

Gnorimus variabilis L. 'In decayed oak trees and found annually in some plenty near Windsor by Mr. Griesbach' (Stephens, 1830). Retaken by Mr. Bowring at Forest Farm, near Windsor Forest, in 1889. It was next taken by us in 1925. We have taken it in considerable numbers in all stages in the black wood-mould in the forks of old oaks, and have reared it from the larva. The story of our first capture is rather amusing and worth repeating here. On July 24th, 1925, we took a mounted specimen (which had been

lent to us) in a box to Windsor Forest and showed it to the Forester and some of the woodmen. We asked them if they had ever seen a beetle like that and they said they had not. The Forester asked us where it would be likely to be found. I explained and, looking round, pointed to an old oak which I said would be suitable if we could get up into the forks. The Forester said he was going back to the offices and would send us a short ladder. This was done, and on mounting up into the forks of the tree Miss Kirk immediately found a fine specimen resting on the wood-mould. After lunch the Forester returned to see how we had got on, and we showed him the live specimen in a large glass-topped box. After looking at it for some time he asked to see the specimen in the other box again!

BUPRESTIDAE.

Phaenops cyanea F. 'A specimen is in the collection of Mr. J. H. Griesbach, I believe taken in the vicinity of Windsor' (Stephens, 1830).

Agrilus sinuatus Ol. 'One was taken towards the end of September in Windsor Forest—J. H. Griesbach, Esq.' (Stephens, 1830). Rediscovered by us July 26th, 1927. It is widely distributed on old hawthorn trees, and we have taken it in some numbers; on one day we beat over twenty specimens off one old hawthorn.

A. laticornis Ill. By beating hawthorn trees and by general and evening sweeping; common. (vii, viii.)

A. angustulus Ill. Under similar circumstances as the above and equally common. (vi, vii, viii.)

Melanophila acuminata De Geer. The 'fire beetle.' Dug out of and by beating burnt pines, one on road; not common. (vii, viii, x.)

EUCNEMIDAE.

Throscus dermestoides L. Some eight specimens have been taken in sand-pits, one in hollow tree; not common. (v, viii.)

T. carinifrons Bond. By beating hawthorn, in 'Sulphur Bracket,' and abundant by evening sweeping. (iv, v, vi, vii, viii, ix.)

T. elateroides Heer. In 'Sulphur Bracket'; scarce. (iv.)

T. obtusus Curt. Several in sand-pit; scarce. (v.)

Melasis buprestoides L. Under beech bark and on beech logs; thirty-six specimens and some larvae were found in a small fallen oak bough. (iv, v, vi, viii.)

Eucnemis capucina Ahr. A small series was taken in an old ash tree, one swept, and one in hollow beech tree; scarce. (vi, viii.) This is the only locality in Britain, except the New Forest, where this rare beetle has been taken.

Elateridae.

Lacon murinus L. Larvae and adult under stones; not common. (vii.)

Cardiophorus thoracicus Er. 'Windsor—Dr. Leach' (Stephens, 1830). Windsor Forest (T. Desvignes), bought at his sale by E. W. Janson (*teste* Oliver Janson). There are four specimens in the Stephensian Collection.

Cryptohypnus 4-pustulatus F. A few specimens of this pretty little beetle have been taken by general sweeping; scarce. (vi, vii.)

Elater rufipennis Steph. (Fowler incorrectly gives this species as a synonym of *E. sanguineus* L. The latter is confined to fir and pine trees; its thorax is much more punctured and has a central furrow, etc.) Dug out of old felled beech trees in some numbers, twenty specimens on one occasion; one by beating hawthorn blossoms; local. (i, ii, iii, iv, v, vi.) A specimen emerged in a tin of frass, April 1st, 1928, reared from a larva taken in 1925.

E. lythropterus Germ. 'Windsor' (Fowler, 1890). We do not know where Fowler got this record from and are inclined to think it refers to the above species.

E. coccinatus Rye. 'Taken in Windsor Forest by Mr. T. H. Griesbach and the late Mr. A. Griesbach and R. Sharman' (Rye, 1867). Under oak bark, crawling on wood-mould in the forks of old oaks and by brushing in hollow oaks; rare. (ii, vi, vii.) One specimen emerged in tin, February 11th, 1928, reared from a larva taken in 1925.

E. elongatulus F. By beating hawthorn blossoms, at roots of trees and in rotten oak log; not common. (v, vi.)

E. balteatus L. In rotten oak logs; larvae, pupae and imagos in wood-mould in hole in oak tree, by beating hawthorn blossoms, and abundant running about on fir stumps in the sun. Three specimens emerged in tin, February, 1928, reared from larvae taken in 1925; common. (ii, iv, v, viii.)

E. nigrinus Payk. 'The specimen in Mr. Griesbach's collection taken I believe near Windsor' (Stephens, 1830). 'Under "Windsor Forest" in the late E. W. Janson's diaries is the *Elater nigrinus* taken there by Griesbach, from the J. Curtis Collection' (*teste* Oliver Janson). It is probable that these records refer to the next species.

E. nigerrimus Lac. (*aethiops* Fowler nec Lac.; *rufitarsis* Desvignes). 'I found three specimens of this insect in old decayed wood, Windsor Forest, March 7th, 1841' (T. Desvignes). 'Windsor Forest, Desvignes and Turner' (Fowler). I took three specimens in an old decayed oak, larvae being numerous, October 26th, 1925.

Subsequently in numbers from several remains of felled oak trees. Several emerged in tin in 1928, reared from larvae taken in 1925. One specimen resting on the stem of a small elder tree, 31.v.27, and one by beating hawthorn blossoms, 30.v.35, are the only specimens taken at large. (ii, iv, v, x.)

Ischnodes sanguinicollis Panz. 'Windsor by W. Griesbach, Esq.' (Stephens, 1930). I took sixteen specimens in the black wood mould from the centre of a hollow ash tree which had just been cut down on February 15th, 1928.

Megapenthes lugens Redt. I have taken two specimens of this very rare beetle on different occasions by beating hawthorn blossoms. (v.)

M. tibialis Lac. 'Windsor — Griesbach' (Fowler). By brushing in hollow tree, in decayed oaks, and on black wood-mould in forks of oaks; one in bird's nest; fourteen specimens in a felled beech tree; rare but widely distributed. (v, vi, viii, x.)

Ludius ferrugineus L. 'Windsor—Dr. Leach' (Stephens, 1830). On July 23rd, 1926, we took eight larvae (which I knew by the very large size of some of them could only belong to this very rare beetle) in the wood-mould of a felled ash in company with the larvae of *Dorcus parallelopepidus*. These were taken home and fixed up in tins filled with frass, and they were supplied with *Dorcus* larvae. They devoured the latter, pupated in large cells made of frass, and emerged in June, 1927. Subsequently many more larvae were taken, at different times, in decayed ash, beech and elm trees, and most of them were successfully reared by Miss Kirk. One teratological specimen with a two-branched antenna was reared. It is curious we only found larvae and remains of the perfect insect; never living adults, nor even pupae.

Melanotus punctolineatus Pel. (*Ectinus aterrimus* Steph.). 'Windsor' (Stephens, 1839).

M. rufipes Hbst. Under fir, beech, elm and oak bark, in bird's nest and by beating fir-tops. Larvae taken in 1925, emerged in tin in 1928. Very common. (i, ii, v, vii.)

M. castanipes Payk. Two specimens were taken in wood-mould in large felled beech; scarce. (viii.)

Athous rhombeus Ol. Under elm, beech, birch and oak bark. Larvae and pupae frequently found and reared; common. (v, vi, vii, viii.)

A. niger L. On bracken, by sweeping and beating young Scots pines; not common. (vii, viii.)

A. longicollis Ol. By general sweeping, only males taken; common. (vi, vii.)

A. haemorrhoidalis F. By general beating and sweeping, beating sallows and hawthorn blossoms; common. (v, vi, vii.)

A. vittatus F. By sweeping and beating hawthorn and sallows; scarce. (v, vi.)

A. vittatus F. ab. *filicti* Buys. By beating hawthorn; scarce. (v.)

Limonius cylindricus Payk. Common by beating hawthorn blossoms. (v.)

L. minutus L. By beating hawthorn, broom, spruce, etc., and by sweeping; common. (v, vi, vii.)

Limoniscus violaceus Mull. In old beech stump, one adult (Allen) (v), larva Donisthorpe (vi).

Sericosomus brunneus L. By beating sallows and hawthorn; scarce. (v, vi.)

Adrastus limbatus F. By beating hawthorn and sweeping; not common. (v, vi, vii.)

Agriotes sputator L. Under stones, in cut grass, by sweeping, etc.; common. (v, vi, viii.)

A. obscurus L. Under stones, on paths, in reed-refuse, by sweeping, etc.; common. (v, vi, vii, viii.)

A. lineatus L. Under stones, by beating hawthorn, by sweeping, and in haystack bottom; common. (v, vi, xi.)

A. sobrinus Kies. By beating hawthorn and *Rhododendron* blossoms, sweeping, in cut grass, under stones, etc.; common. (iv, v, vi, vii.)

A. pallidulus Ill. By beating hawthorn and crab-apple blossoms and sweeping; especially common by sweeping bluebells. (iv, v, vi, vii, viii.)

Dolopius marginatus L. In sand-pit, by beating hawthorn and oaks, and by sweeping; common. (iv, v, vi.)

Corymbites quercus Gyll. By beating young birches, hawthorn, etc., and by sweeping rushes, etc.; common. (v, vi.)

C. quercus Gyll. ab. *ochropterus* Steph. With the typical form, but much rarer. (vi.)

C. holosericeus F. By beating hawthorn, oaks, etc.; not uncommon. (v, vi.)

C. cruciatus L. 'Rare: but taken by the late W. Griesbach, Esq., near Windsor, of whose capturing four or five examples are in the British Museum' (Stephens, 1830). 'Windsor Forest' (T. Desvignes); bought at the sale of his collection by the late E. W. Janson (*teste* Oliver Janson). There are five examples in the drawer of doubtful British Coleoptera in the British Museum.

Adelocera quercea Hbst. 'I have seen but one specimen which was taken in Windsor Forest. J. H. Griesbach, Esq.' (Stephens,

1830). A specimen was taken by Mr. A. Allen, and a second and a larva by myself, in an old oak in September, 1936.

Campylus linearis L. By sweeping and beating hawthorn and sallows; a pupa taken in a beech stump became a perfect insect in a few days; not uncommon. (v, vi.)

DASCILLIDAE.

Helodes minuta L. By beating hawthorn, oak and sallows; sweeping reeds, etc., in damp places; common. (v, vi, vii, viii.)

Microcara livida F. By beating alders, oaks, etc., and sweeping in damp places; common. (v, vi, vii.)

Cyphon nitidulus Th. In swan's nest and by sweeping in damp places; common. (vi.)

C. variabilis Thunb. Abundant in swan's nest, in grass and refuse round ponds and by sweeping in damp places; common. (iv, v, vi, vii, viii, ix.)

C. pallidulus Boh. By sweeping in damp places; abundant by sweeping sedge; common. (vi, vii, viii.)

C. padi L. In swan's nests, by beating Mountain Ash and *Prunus* blossoms and by sweeping; common. (iv, v, vi, ix, x.)

Prionocyphon serricornis Müll. The larvae of this insect are common in holes full of water, dead leaves, etc., in and at the foot of beech and oak trees. They can be easily reared by keeping them in bowls containing water and dead leaves, etc. Larvae (viii). Larvae taken 31.viii.26, emerged as perfect insects 6.vi; 21, 25 and 30.vii.27. Adults: one taken in hollow beech, 1.viii.30; one in hole in beech tree, 16.vi.31.

Scirtes hemisphaericus L. In moorhen's nest and in plenty by sweeping reeds, rushes, etc., round ponds; common. (vi, vii.)

LAMPYRIDAE.

Lampyris noctiluca L. Though we have not taken the adults of the common 'glow-worm,' its larva has been swept, showing that it occurs here. (vi.)

TELEPHORIDAE.

Podabrus alpinus Payk. By beating hawthorn blossoms and on the wing; common. (v, vi.) The black form is much less common.

Telephorus rusticus Fall. By sweeping and beating hawthorn blossoms; common. (v, vi.)

T. lividus L. Found under the same circumstances as the preceding and equally common. (v, vi.)

T. pellucidus F. Also common. *T. nigricans* Müll. and ab. *discoideus* Steph. Also common.

T. rufa L. and ab. *liturata* Fall. By sweeping long grass, etc. The typical form is much rarer than the aberration. (v, vi.)

T. bicolor F. By beating hawthorn and by sweeping; not very common. (v, vi.)

T. haemorrhoidalis F. By sweeping in willow-swamp, beating hawthorn, etc.; common. (v, vi.)

T. oralis Germ. By sweeping ox-eye daisies, etc.; not common. (vi.)

T. fulvicollis F. and ab. *flavilabris* Fall. By sweeping Umbelliferae, etc.; common. (vi, vii.)

T. thoracicus Ol. By sweeping *Spiraea*, and reeds in willow-swamp, etc.; not uncommon (vii). The abs. *theresae* Pic and *suturalis* Schil. occur sparingly with the typical form.

Rhagonycha unicolor Curt. By sweeping long grass; scarce. (vi.)

R. fuscicornis Ol. By beating hawthorn and sweeping in damp spots, etc.; not very common. (vi, vii.)

R. fulva Scop. Very abundant on ragwort, etc. (vii, viii.)

R. testacea L. By beating hawthorn and by sweeping long grass in damp places, etc.; not common. (v, vi, vii.)

R. limbata Th. Common by beating hawthorn blossoms. (v.)

R. pallida F. By beating birch and hawthorn; common. (v.)

Malthinus punctatus Fourc. By beating hawthorn and lime trees; not common. (v, vi, vii.)

M. fasciatus Ol. By beating hawthorn, oak and elderberry and by sweeping; common. (v, vi, vii, viii.)

M. balteatus Suff. One specimen by beating lime trees (A. A. Allen). (vii.)

M. frontalis Marsh. By beating oaks, sweeping, etc.; not uncommon. (vi, vii.)

Malthodes marginatus Latr. By beating hawthorn and sweeping; common. (v, vi.)

M. flavoguttatus Kies. By sweeping in willow-swamp and beating elder; scarce. (vi.)

M. guttifer Kies. By beating hawthorn blossoms; scarce. (v.)

M. dispar Germ. By sweeping; very local. (vi.)

M. minimus L. Abundant by sweeping reeds, etc. (vi, vii.)

M. crassicornis Maek. One specimen swept off bracken, 24.vi. 1837 (*A. A. Allen*).

M. atomus Th. By sweeping rather short grass; not common. (vi.)

Malachius bipustulatus L. Abundant by beating hawthorn, sallows, etc., and by general sweeping. (v, vi.) Some nice bronze and blue forms occur.

M. bipustulatus L. ab. *immaculicollis* Muls. & Rey. By sweeping in company with the typical form. (vi.)

M. viridis F. By sweeping, 10.v.93. I have never been able to find it again.

M. lusitanicus Er. var. *australis* Muls. One specimen by sweeping long grass, 16.vi.31. The only British record.

M. marginellus Ol. By sweeping; very local. (vi, .vii, viii.)

Ebaeus pedicularis Schr. (*Malachius productus* Steph.). 'Windsor. Dr. Leach' (Stephens, 1830). There are three specimens in the Stephensian collection and three in the drawer of doubtful British species in the British Museum.

Axinotarsus ruficollis Ol. In profusion by sweeping long grass, etc., in a lane; very local. (vii.)

Anthocomus rufus Hbst. By sweeping in willow-swamp and herbage round mere; very local. (viii, ix.)

A. fasciatus L. In deer-pen, by beating hawthorn and by sweeping long grass; not common. (vi, vii.)

Dasytes flavipes F. By sweeping comfrey, etc.; common. (vii, viii.)

D. aerosus Kies. By sweeping and beating hawthorn; two bred from an oak bough; common. (v, vi.)

D. oculatus Kies. In some numbers by sweeping in willow-swamp; very local. (vi, vii.)

D. niger L. 'It has been taken near Windsor. Dr. Leach' (Stephens, 1830).

Haplocnemus impressus Marsh. Under bark of oak, elm, etc.; on the wing, by beating hawthorn, etc. A pupa taken in 'Tinder Bracket' fungus 20.ix.27, emerged 12.x.27; not uncommon. (i, iv, v, vi, vii, ix, x.)

CLERIDAE.

Tillus elongatus L. On old oak and beech trees, especially when infested by *Ptilinus pectinicornis* L.; rather common. (vi, vii.)

T. elongatus L. var. *bimaculatus* Don. 'Windsor' (Stephens, 1839).

T. unifasciatus F. 'It has also been taken not infrequently near Windsor' (Stephens, 1830). Windsor Forest (Desvignes); bought by the late E. W. Janson at the sale of Desvignes' collection (*teste* the late Oliver Janson).

Opilo mollis L. On grass stem, under 'Poor Man's Beef' fungus on oak, and by beating lime trees; scarce. (vi, vii, xi.)

Thanasimus formicarius L. 'Windsor, Dr. Leach' (Stephens, 1830). By beating hawthorn, Scots pines and lime trees; in the

borings of *Tomicus laricis* and *Dryocetes villosus*; in numbers flying over large felled Scots pines. Its pink larvae may often be found in the burrows of wood-boring beetles; common. (v, vi, viii, ix, x.)

Necrobia ruficollis F. On bones and by sweeping; not common. (vii, viii, ix.)

N. violacea L. On old bones, dead birds, animals, etc.; common. (v, vi, vii, x.)

N. rufipes De G. By sweeping; rare. (x.)

Lymexylonidae.

Lymexylon navale L. 'This extraordinary insect has long been reported to inhabit Britain, but until July, 1829, no authentic specimen had occurred; at that period, however, a single female was taken out of an old oak in Windsor Forest by my friend J. H. Griesbach, Esq.' Widely distributed and sometimes abundant flying over felled oak trees, chestnut trees, etc. Females frequently found ovipositing in cracks in old or felled oak trees, etc. We have given the following account of the marriage flight of this insect at Windsor:—

'A few females occurred at intervals during the day, settling on old oak trees, but at about 5.30 p.m. (summer time) a marriage flight took place, which lasted for some two hours. Males and females commenced to fly high up round the trees, occasionally settling on the upper branches, where I believe copulation took place. I confined a female in a small muslin bag and fastened it aloft on a tree; numerous males on the wing made for this tree, swooping and settling on it, and flying off again. Some males and females seemed to arrive in a bee-line from a distance and to join in the joyous flight. Females, after flying round, would settle out of sight on a leafy bough, and males would be seen to fly round and alight on such branches. Every now and then a female would settle on a tree and commence to lay, thrusting her ovipositor and indeed often half her body into the cracks of the tree. After waiting some time she would move to other cracks and repeat the same performance, eventually flying away. There were more males than females, though there were plenty of both sexes present.' (vi, vii, viii.)

Ptinidae.

Ptinus lichenum Marsh. 'Windsor. Mr. Waterhouse' (Stephens, 1830).

P. subpilosus Müll. In frass in *brunneus* oak trees in company with the ants; one female swept; rare. (iv, vi, viii.)

Niptus hololeucus Fald. One specimen in a fungus-dump, 23.ix.28. I can only suggest that this beetle had been introduced in the food for pheasants.

N. crenatus F. In hotels in Windsor and Old Windsor. (vii, viii.)

Hedobia imperialis L. By beating hawthorn and lime trees; rare. (v, vii.)

Mezium affine Boield. One specimen alive in sugar castor in hotel. (vii.)

ANOBIIDAE.

Dryophilus pusillus Gyll. By beating elder blossoms and by sweeping; scarce. (vi, x.)

Priobium castaneum F. By beating hawthorn and on stacks of beech wood; scarce. (v, vi.)

P. eichhoffi Seidl. On the wing, on old dead beech and oak trees, on stacks of wood; ♂ and ♀ *in cop.* under oak bark; commoner than the preceding. (v, vi, vii.)

Anobium denticolle Panz. In the wood of, and crawling on, old hawthorn tree; pupa taken 2.viii.29, emerged 16.viii.29; very local. (vii, viii.)

A. domesticum Fourc. Reared from a piece of a thick stem of ivy, also by sweeping, beating lime trees and mistletoe, under oak and beech bark, in deer-pens, on stacks of wood, etc. This 'furniture beetle' is frequently met with out of doors here, breeding freely in old oaks, etc. (iv, vi, vii, viii, x, xi.)

A. fulvicorne Sturm. On old trees and logs, by sweeping and beating hawthorn; common by beating oak branches. (vi, vii.)

A. pertinax L. 'Windsor' (Stephens, 1839). There is a specimen in the Stephensian collection.

Gastrallus laevigatus Ol. By sweeping, beating maple and in some numbers on stack of elm logs (Donisthorpe and Allen). (vi, vii, viii.) This capture was a genus and species new to Britain.

Xestobium tessellatum F. In beech, hawthorn and oak trees. We have sometimes found this beetle, which destroyed the roof in Westminster Hall, in numbers under bark of old oaks. (iv, v, vi.)

Ernobius mollis L. Under the bark of a spruce fence, dug out of Scots pines, by beating fir tops and burnt Scots pine; common in the bark of a large dead larch tree. (v, vi, vii, viii.)

E. mulsantianus Sharp. In numbers by beating young burnt pines. (vi, vii, viii.)

E. oblitus Sharp. In company with the above but much less common. (vii, viii.)

E. reversus Sharp. In company with the above; scarce. (vii.)

Ptilinus pectinicornis L. On stacks of wood and oaks, but very common in beech trees. (vi, vii.)

Ochina hederae Müll. By sweeping, beating hawthorn and ivy stems, brushing in hollow oak, etc.; not common. (vi, vii.)

Caenocara bovistae Hoffm. 'Windsor. Dr. Leach' (Stephens, 1830).

Dorcatoma chrysomelina Sturm. In bird's nest, in old oaks, cherry tree, etc.; abundant on felled oaks. (vi, vii, viii, x.)

D. dresdensis Hbst. In June, 1925, I reared this species in numbers from a 'Tinder Bracket' fungus taken on an old oak in April, 1924.

D. serra Panz. I have reared it in numbers from the 'Dryad' fungus (*Polyporus dryadeus*) and also from 'Tinder Bracket.' (vi.)

D. flavicornis F. 'Found in some numbers in a hollow decayed beech' (A. J. Chitty, 1893). By evening sweeping, beating faggots, on stacks of wood, etc.; not uncommon. (vii, viii.)

Anitys rubens Hoffm. In powdery 'cheesy' oak wood, in oak frass and several in *brunneus* oak; scarce. (vii.)

LYCTIDAE.

Lyctus canaliculatus F. On stacks of wood, under bark of oak stump, in elm bough and in numbers on new oak palings. (v, vi, vii, viii.)

L. brunneus Steph. On new oak fence, on elm bough and under boards in saw-mill; not common. (vii, viii.)

(To be continued)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

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(Continued from p. 77)

SPHINDIDAE.

Sphindus dubius Gyll. By sweeping, on the wing over stack of wood and frequent in the powdery fungus *Reticularia lycoperdon* on stumps. (vi, viii, ix, x.)

CISSIDAE.

Cis boleti Scop. In *Trametes gibbosa* on beech, and especially *Polystictus versicolor*; very abundant. (ii, vi, viii, ix, xi.)

C. villosulus Marsh. In the same fungus as the above but not so common; one specimen by beating sallows. (ii, iii, iv, v, vi, viii, ix.)

C. micans F. In *Polystictus versicolor* on felled oak; very local. (ix.)

C. hispidus Payk. In the same fungi as *C. boleti*; not uncommon. (vi, viii.)

C. bidentatus Ol. In *Fomes ulmarius*, *Trametes gibbosa*, 'Sulphur Bracket' and 'Birch Bracket' fungi; also by sweeping; common. (iv, v, vi, viii, ix.)

C. alni Gyll. In 'Jew's Ear' fungus (*Hirneola auricula-judae*), in bird's nest, in the topmost branches of ash trees, and by beating lime trees; not common. (ii, iii, v, vi, vii.)

C. coluber Abeille. One specimen was taken crawling on the branch of a felled oak, 17.vii.25. I have not been able to find it again. The late Colonel Sainte-Claire Deville told me that it occurred in well-preserved oak forests in France.

C. nitidus Hbst. In 'Tinder Bracket' fungi (*Fomes fomentarius* and *F. ulmarius*); abundant. (iv, v, vi, viii, ix, xi.)

C. jacquemarti Mell. This northern species occurs in great numbers in *Fomes fomentarius*. (i, viii, ix, x.) I believe this is its only English locality.

C. pygmaeus Marsh. By sweeping, on beech and oak logs; plentiful by beating oak branches. (vi, vii, viii, x.)

C. rhododactylus Marsh. (*pygmaeus* Fowler). In fungi on stumps, in powdery white wood-frass of oaks, by evening sweeping, and in straw in deer-pen; less common than the above. (vi, vii.)

C. fuscatus Mell. In 'Birch Bracket,' 'Tinder Bracket' and the 'Dryad' fungi, often abundant in 'Sulphur Bracket,' on oak logs and under hawthorn bark; common. (v, vi, vii, viii, ix, x.)

C. quadridentellus Perris. In the 'Dryad' fungus in a hollow beech; very scarce. (vi.) The only British record.

C. bilamellatus Wood. In *Trametes gibbosa, Fomes fomentarius* and in great numbers in *Polyporus betulinus*; common. (ii, vi, viii, ix, x, xi.)

C. savilli Donis. By sweeping *Carex* in *Sphagnum* swamp; one specimen, 9.vi.36.

Rhopalodontus fronticornis Panz. In numbers in *Trametes gibbosa, Polystictus versicolor,* 'Sulphur Bracket,' etc.; common. (v, vi, viii.)

Ennearthron affine Gyll. In 'Tinder Bracket,' *Polystictus versicolor,* under oak bark, etc.; common. (ii, iv, vi, ix, xi.)

E. cornutum Gyll. In 'Dryad's Saddle,' 'Sulphur Bracket,' 'Tinder Bracket,' 'Birch Bracket' fungi, etc.; common. (iv, vi, viii, ix, x.)

Octotemnus glabriculus Gyll. In *Trametes gibbosa, Polystictus versicolor,* etc.; common. (vi, viii, ix.)

Prionidae.

Spondylis buprestoides Fab. 'I have seen but one indigenous specimen of this, which was taken in Windsor Forest, August, 1831.—Rev. F. W. Hope' (Stephens, 1831). There are two specimens in the Hope-Westwood British Collection of Coleoptera in the Oxford University Museum. One is labelled 'Coll. Hope' and the other bears a label 'Windsor Forest. F.W.H.' The latter is no doubt the example referred to by Stephens.

Prionus coriarius Linn. 'Windsor Forest. Mr. J. C. Bowring has taken several specimens this summer (1889) in this locality, all of which "emerged from roots of oak trees running along the ground, leaving holes like those of bees' nests"' (Fowler, 1890). A ♂ was taken by Miss Kirk at the foot of an oak tree, 12.viii.26. We found several females in other years, and the larvae in a birch stump; decidedly scarce. (viii.)

Cerambycidae.

Criocephalus polonicus Mots. On young burnt pine, under pine bark, and in numbers in the roots of burnt Scots pines. (v, vii, viii.)

Asemum striatum Linn. On the wing, on fir stumps, and common in Scots pine stumps. (v.)

A. striatum L. ab. *agreste* Fab. In company with the above, but much less common. (v.)

Tetropium gabrieli Weise. Remains and borings in large felled larch; very local. (vi.)

Callidium variabile Linn. 'Windsor' (Stephens, 1839). On old oak and beech logs, in oak branches and under oak bark, also on the wing; larvae abundant in dead chestnut and poplar; not common. (vi, vii.)

C. alni Linn. On the wing, by beating hawthorn and Rhododendrons, on freshly cut wood and in dead oak bough; scarce. (v, vi.)

Clytus arietis Linn. By beating hawthorn, in branch of hornbeam, on stumps and felled trees; common on stacks of wood. (v, vi, vii.)

C. mysticus Linn. On stacks of wood, on the wing, and commonly by beating hawthorn blossoms. (v, vi.)

C. mysticus Linn. ab. *hieroglyphicus* Hbst. One specimen found on net after digging in old hawthorn, 28.v.26.

Gracilia minuta Fab. By beating lime trees (Allen and Donisthorpe); scarce. (vii.)

Molorchus minor Linn. 'It has been taken near Windsor' (Stephens, 1831). Under bark of felled spruce, by sweeping, and not uncommonly by beating hawthorn blossoms. (v, vi.)

Rhagium bifasciatum Fab. Under bark of oak, common in Scots pine stumps, on the wing, by beating rhododendrons and often abundantly by beating hawthorn blossoms. (v, vi, viii, ix.)

Toxotus meridianus Panz. By beating hawthorn trees; scarce. (v, vi.)

Leptura scutellata Fab. On the wing, on beech trees, and frequent in decayed birch and beech trees. (v, vi, vii.)

L. livida Fab. Abundant by sweeping flowers and herbage. (vi.)

Strangalia revestita Linn. 'I possess specimens of this rare species . . . found in the vicinity of Windsor. Windsor, Dr. Leach' (Stephens, 1831). Windsor Forest (Desvignes); bought at the sale of his collection by the late E. W. Janson (*teste* the late Oliver Janson). There are four specimens in the Stephensian collection.

S. attenuata Linn. Windsor Forest (Desvignes); bought at the sale of his collection by the late E. W. Janson (*teste* the late Oliver Janson).

S. armata Hbst. On the wing, on dog-roses and bramble blossoms; not common. (vi.)

Grammoptera tabacicolor De Geer. By beating holly blossoms, common by beating hawthorn blossoms. (v, vi.)

G. analis Panz. By beating hawthorn blossoms; very local but sometimes abundant. (v.)

G. ruficornis Fab. Common by beating hawthorn blossoms. (v, vi.)

G. holomelina Pool. By beating crab-apple and hawthorn blossoms; scarce. (v.)

G. praeusta Fab. By beating hawthorn blossoms; local but sometimes not uncommon. (v.)

Lamiidae.

Leiopus nebulosus Linn. In and under chestnut, birch and oak bark; on the wing, by beating oaks and hawthorns; common. (iv, v, vi, vii.)

Pogonochaerus dentatus Fourc. By beating holly blossoms; scarce. (vi.)

Mesosa nubila Ol. 'Windsor. Dr. Leach' (Stephens, 1831). By beating hawthorn trees; scarce. (v.)

Saperda populnea Linn. I have no found the perfect insect, but have obtained the galls made by the larvae in aspen stems.

Tetrops praeusta Linn. By beating hawthorn blossoms; abundant. (v, vi.)

Bruchidae.

Bruchus rufimanus Boh. By sweeping Umbelliferae, rushes, etc.; not common. (vi.)

B. rufipes Hbst. By beating lime trees; scarce. (vii.)

B. loti Payk. By beating hawthorn and by sweeping *Lathyrus pratensis*; common. (v, vi, vii, viii.)

B. villosus Fab. By sweeping; scarce. (v.)

Chrysomelidae.

Orsodacna lineola Panz. By beating hawthorn blossom; scarce. (v.)

Donacia crassipes Fab. 'On the water-lily, Windsor.—Mr. G. Waterhouse' (Stephens, 1831).

D. dentata Hopp. 'On the water-lily, Windsor.—Mr. G. Waterhouse' (Stephens, 1831).

D. versicolora Brahm. 'Frequent near Windsor. Windsor Forest.—Mr. G. Waterhouse' (Stephens, 1831). In some numbers on Arrow-head (*Sagittaria sagittifolia*); local. (vii.)

D. limbata Panz. Common on reeds, etc. (vi.)

D. obscura Gyll. 'Water-lily, Windsor.—Mr. G. Waterhouse' (Stephens, 1831).

D. thalassina Germ. On reeds; scarce. (vi.)

D. simplex Fab. By sweeping reeds, etc., round ponds; abundant. (v, vi, vii, viii.) Purple and red aberrations occur.

D. vulgaris Zach. By sweeping *Sparganium*; scarce. vii.

D. clavipes Fab. By sweeping aquatic plants; not uncommon. (vi.)

D. semicuprea Panz. With the preceding; local. (vi.)

D. cinerea Hbst. By sweeping Bur-reed (*Spharganium ramosum*), etc.; locally abundant. (vi.)

D. discolor Panz. By sweeping aquatic plants; not uncommon. (v, vi.) Mostly brassy-coloured specimens taken, but purple and melanic (ab. *nigrita* Schil.) specimens occur.

Haemonia curtisi Lac. (*zosterae* Stephens). 'It has also occurred near Windsor' (Stephens, 1931). As this species is only found in brackish water, it is probable that Stephens' record refers to the allied species.

H. appendiculata Panz. (*equiseti* Stephens). 'In the collection at the British Museum are a pair of insects bearing the above name, which were found near Windsor' (Stephens, 1931).

Zeugophora subspinosa Fab. By sweeping and beating aspens; not common. (vii, viii.)

Lema cyanella Linn. By sweeping thistles and Dyer's Weed (*Genista tinctoria*); not common. (v, vii, viii.)

L. lichenis Voet. By sweeping thistles, etc.; abundant by beating lime trees; common. (vi, vii, viii.) A green aberration swept.

L. obscura Steph. 'Windsor.—Mr. Waterhouse.' This, judging by the size, is probably a melanic form of the above. Stephens describes it as black above, shining black-blue beneath.

L. melanopa Linn. Abundant by sweeping coarse herbage. (vi, viii.)

Crioceris asparagi Linn. One by sweeping reeds, 28.vi.35. I have hunted for it in vain on asparagus plants in the gardens of Cumberland Lodge, etc.

Clythra quadripunctata Linn. A larva was taken in a nest of *Formica rufa*, 3.v.36. I have not yet found the perfect insect.

Cryptocephalus lineola Fab. By sweeping mixed herbage, hawthorn and grass, etc.; not uncommon. (vi, vii, viii.)

C. bipunctatus L. ab. *thomsoni* Weis. One specimen swept off Cross-leaved Heath (*Erica tetralix*), 16.vi.34.

C. aureolus Suffr. In numbers in buttercups and hawkweed. (v, vi.)

C. parvulus Müll. By sweeping young birch trees; scarce. (viii.)

C. moraei Linn. By sweeping St. John's Wort (*Hypericum perforatum*); local but abundant. (vii.)

C. fulvus Goeze. By sweeping rough herbage; scarce. (viii.)

C. pusillus Fab. By general sweeping, evening sweeping, beating oak bushes, birch, hawthorn, etc.; very common. (vii, viii, ix.) Very variable in colour. One larva in case taken in a nest of *A. (D.) brunneus*.

C. labiatus Linn. By beating hawthorn, birch, etc., and by general sweeping; very common. (vi, vii, viii.)

C. querceti Suffr. There is a specimen in the Hope-Westwood Collection in the Oxford University Museum labelled 'Windsor F. July 17th, 1820.' On old oak trees and by beating oaks and hawthorns; not uncommon. (vi, vii, viii.) The only other British locality is Sherwood Forest.

Timarcha violaceo-nigra De Geer. On grassy paths; not uncommon, but local. (v, ix.)

Chrysomela staphylea Linn. In moss and by sweeping Wood Sage (*Teucrium Scorodonia*); scarce. (v, ix.)

C. polita Linn. Under bark of felled oak, in moss and by sweeping water-mint (*Mentha hirsuta*); common. (v, vi, vii, x, xi.)

C. hyperici Först. By sweeping grass and especially St. John's Wort; common. (vii, viii, x.)

C. lurida Linn. 'In the British Museum; captured near Windsor in June' (Stephens, 1831). There are two specimens in the drawer of doubtful British beetles in the British Museum Collection.

C. limbata Fab. 'Very rare; specimens have been taken near Windsor in June' (Stephens, 1831). There are two specimens in the Stephensian Collection.

C. violacea Goeze. 'A specimen in the collection of its captor was taken near Windsor.—J. H. Griesbach, Esq.' (Stephens, 1831). 'One from Windsor is in the collection of the late Mr. W. Garneys' (Fowler, 1890).

Melasoma populi Linn. By sweeping in willow-swamp; larvae and adults abundant on sallows. (vii, viii, ix.)

M. tremulae Fab. On young aspens; not common. (v, vi.)

Phytodecta rufipes De Geer. By beating aspens; scarce. (v.)

P. viminalis Linn. Abundant on sallows. (v.)

P. olivacea Först. In numbers by sweeping broom. (v.)

Gastroidea polygoni Linn. In sand-pit, by sweeping coarse herbage, etc.; common. (v, vi, viii.)

Plagiodera versicolora Laich. By sweeping in willow-swamp; scarce. (vi.)

Phaedon tumidulum Germ. In moss in willow-swamp, in flood-refuse; abundant by sweeping Hogweed (*Heracleum Sphondylium*). (v, vii, viii, xii.) Copper-coloured forms occur.

P. armoraciae Linn. In moss and flood-refuse; abundant on mud round ponds and on the surface of dried-up ponds. (iv, v, vi, vii, viii, x.)

P. cochleariae Fab. On banks of pond, by sweeping water-cress (*Nasturtium officinale*) and by general sweeping; common. (v, vi, vii, ix.)

Phyllodecta cavifrons Thoms. By sweeping and in plenty by beating young aspens and poplars. (v, viii.)

P. vitellinae Linn. By beating sallows and young poplars; common. (v, vi, vii, viii, x.)

Prasocuris phellandrii Linn. By dragging in pond; scarce. (iv.)

Phyllobrotica quadrimaculata Linn. Plentiful on the common Skull-cap (*Scutellaria galericulata*); local. (viii, ix.)

Luperus rufipes Scop. 'On the birch, not common near Windsor.—Mr. G. Waterhouse' (Stephens, 1831). By beating rhododendrons and hawthorn; abundant by beating young birch trees. (v, vi, vii.)

L. flavipes Linn. By beating birch, hawthorn and mountain ash; common. (v.)

Lochmaea capreae Linn. By sweeping in damp spot and beating hawthorn; abundant on sallows. (v, vi, viii.)

L. suturalis Thoms. In sand-pit; abundant by sweeping grass and heather. The ab. *nigrita* Weise occurs with the typical form. (iii, iv, v, viii, ix.)

L. crataegi Först. Abundant by beating hawthorn blossoms. (iv, v, vi.)

L. crataegi Först. ab. *flavus* Donis. By beating birch and hawthorn; scarce. (vii, viii.)

Galerucella nymphaeae Linn. By sweeping reeds, rushes, *Polygonum amphibium*, etc.; common on yellow water-lily leaves (*Nuphar luteum*). (vii, viii.)

G. sagittariae Gyll. By sweeping sedge, etc., round mere; local and scarce. (ix.)

G. lineola Fab. By sweeping sedge; scarce. (vii.)

G. pusilla Dufts. By sweeping in willow-swamp; not common. (vii.)

Adimonia tanaceti Linn. By sweeping short grass; scarce. (vii.)

Longitarsus holsaticus Linn. 'Windsor' (Fowler, 1890). It is not recorded by Stephens and I do not know the source of Fowler's record. Hitherto I have been unable to find the species.

L. castaneus Fowler (=*castaneus* Foudras nec Dufts., *brunneus* Dufts.). By sweeping in willow-swamp; scarce. (ix.)

L. luridus Scop. By sweeping ragwort, grass, etc.; very common. (v, vi, vii, viii, ix, x.) A form occurs in numbers by beating lime trees.

L. suturellus Dufts. By sweeping in damp places, ragwort, thistles in flower, etc.; common. (viii, ix, x.) The ab. *fuscicollis* Steph. occurs with the typical form, but more sparingly.

L. atricillus Linn. By sweeping; not common. (v, viii, ix.)

L. melanocephalus All. By sweeping herbage; not common. (viii, ix.)

L. nasturtii F. ab. *obscura* Donis. I have taken this insect in considerable numbers by sweeping Comfrey (*Symphytum officinale*) in one field. This is the only locality known anywhere at present. It should perhaps be regarded as a subspecies, as the typical form does not occur with it, nor, as far as I know, in the Windsor area at all. (vi, vii.)

L. lycopi Foudr. By sweeping wood-sage (*Teucrium Scorodonia*), etc.; scarce. (x.)

L. membranaceus Foudr. By sweeping wood-sage; scarce. (x.)

L. waterhousei Kuts. By sweeping; scarce. (vii.)

L. flavicornis Steph. By sweeping in willow-swamp; abundant by beating Convolvulus (*Convolvulus arvensis*) in hedges. (vi, vii, viii, ix.)

L. exoletus Linn. By sweeping Hound's Tongue (*Cynoglossum officinale*); very local but common where it occurs. (vi, vii.)

L. pusillus Gyll. By sweeping in willow-swamp, plantations, etc.; not common. (viii.)

L. jacobaeae Wat. Common by sweeping ragwort (*Senecio Jacobaea*); the ab. *rufescens* Fowl. occurs with it, but more sparingly. (viii, x.)

L. laevis Duft. By sweeping in willow-swamp; abundant by sweeping Wild Chamomile (*Matricaria Parthenium*). (vii, viii.)

L. pellucidus Foudr. In moss in willow-swamp and in some numbers on *Convolvulus arvensis* in the same plate. (ix, x.)

Haltica lythri Aubé. Very local, but abundant by sweeping Purple Loosestrife (*Lythrum Salicaria*). (vi.)

H. britteni Sharp. By sweeping Bell-heather (*Erica cinerea*); scarce. (ix.)

H. ytenensis Sharp. By sweeping Bell-heather; not common. (viii.)

H. oleracea L. In fern-refuse; abundant by sweeping Willow-herb (*Epilobium montanum*). (v, vi, viii, ix, xi.)

H. pusilla Dufts. By sweeping; scarce. (v, x.)

Phyllotreta nodicornis Marsh. Abundant by sweeping Wild Mignonette (*Reseda lutea*); once swept in willow-swamp. (vi, vii.)

P. nigripes F. By sweeping in plantations and avenues; abundant by sweeping Shepherd's Purse (*Capsella Bursa-Pastoris*) and Hedge Mustard (*Sisymbrium officinale*). (vi, viii, ix, x.)

P. consobrina Curt. By sweeping Cruciferae in field, scarce; abundant by sweeping cabbages in garden; very local. (vi, vii, viii.)

P. punctulata Marsh. By sweeping; scarce. (vii, viii.)

P. atra Payk. In flood-refuse, in moss in willow-swamp, by sweeping *Sisymbrium officinale,* etc.; common. (iv, v, vi, viii, ix, xii.)

P. diademata Foudr. By sweeping *S. officinale,* etc.; one specimen by beating larch; scarce. (v, vii, viii.)

P. cruciferae Goez. By sweeping Shepherd's Purse, Hedge Mustard, cabbages, etc.; common and abundant. (vi, vii, viii, ix.)

P. vittula Redt. By sweeping Garlic Mustard (*Alliaria officinalis*), etc.; not uncommon. (v, viii, ix.)

P. undulata Kuts. By sweeping Garlic Mustard, cabbages, etc.; common. (v, vi, vii, viii, ix, x.)

P. nemorum L. By sweeping; not common. (vi, viii.)

P. ochripes Curt. By sweeping Garlic Mustard, etc.; scarce. (iv, vii.)

P. tetrastigma Corn. By sweeping Cuckoo Flower (*Cardamine pratensis*); not uncommon. (v, vi.)

P. exclamationis Thunb. By sweeping in damp spots; scarce. (v, vi.)

Aphthona venustula Kuts. Abundant by sweeping Wood-spurge (*Euphorbia amygdaloides*). (iv, v, vi, vii, ix, x.)

Sphaeroderma testaceum F. By sweeping thistles in flower and by general sweeping; common. (vii, viii.)

S. cardui Gyll. By sweeping thistles, Dyer's Weed (*Genista tinctoria*), Knapweed (*Centaurea nigra*), etc.; not as common as the preceding. (vii, viii, x.)

Apteropeda orbiculata Marsh. In flood-refuse and by general sweeping; not uncommon. (iv, v, vii, viii, ix, x.)

Podagrica fuscicornis L. By sweeping mallows (*Malva sylvestris*); very local and not common. (vii.)

Mantura rustica L. By sweeping; scarce. (vii.)

M. obtusata Gyll. 'Windsor' (Fowler, 1890).

M. matthewsi Curt. 'It has also occurred . . . near Windsor' (Stephens, 1835).

M. matthewsi Curt. var. *helianthemi* Curt. 'Windsor' (Stephens, 1839).

Crepidodera transversa Marsh. By general sweeping; very common. (vi, vii, viii.)

C. ferruginea Scop. By sweeping thistles in flower and by general sweeping; equally common with preceding. (vi, viii, ix.)

C. rufipes L. 'Taken near Windsor—Mr. G. Waterhouse' (Stephens, 1831). By sweeping; not common. (vi, vii.)

C. helxines L. By beating sallows and aspens, and sweeping in willow-swamp; not common. (vi, viii.)

C. chloris Foudr. By sweeping in willow-swamp; not common. (vii, viii.)

C. aurata Marsh. Abundant by beating aspens, sallows, willows and poplars. (iv, v, vi, vii, viii, ix, x.)

C. smaragdina Foudr. By sweeping and beating aspens; not common. (v, vi.)

Chaetocnema subcoerulea Kuts. By sweeping reeds, etc.; common. (v, vi, vii, viii, ix.)

C. arida Foudr. By sweeping in damp places; rare. (vii.)

C. confusa Boh. By sweeping sedges, etc.; rare. (ix.)

C. hortensis Fourc. In flood- and reed-refuse, moss in willow-swamp, etc.; common by sweeping. (v, viii, ix, x, xii.)

Plectroscelis concinna Marsh. In moss in willow-swamp, by beating sallows, and abundant by sweeping mixed herbage. (iv, vi, viii, ix, x.)

Psylliodes chrysocephala L. By sweeping Cruciferae; not uncommon. (vi, vii.)

P. napi Koch. In flood-refuse, in moss in willow-swamp and by sweeping; not uncommon. (iv, v, viii, ix, xi.)

P. affinis Payk. Abundant by sweeping Woody Nightshade (*Solanum Dulcamara*). (vi, vii, viii, ix.)

P. dulcamarae Koch. By sweeping Woody Nightshade; local. (vi, viii.)

Cassida fastuosa Schall. 'It has occurred in the vicinity of Windsor' (Stephens, 1831).

C. nebulosa L. Abundant by sweeping White Goose-foot (*Chenopodium album*); very local. (viii.)

C. vibex F. By sweeping thistles; not common. (v, vi, viii, ix.)

C. vittata Vill. One in flood-refuse, 20.xii.29. This is usually a coast species.

C. nobilis L. By sweeping short herbage and abundant by sweeping White Goose-foot. (v, viii.)

C. flaveola Thunb. By sweeping Dyer's Weed and mixed herbage; rather common. (viii, ix.)

C. equestris F. Abundant on Water Mint (*Mentha hirsuta*) and Gipsy-wort (*Lycopus europaeus*). (viii, ix.) A number of the larvae were taken and many adults were reared. Many of the larvae were parasitised by the small Chalcid *Tetrastichus miser* Nees, which emerged in numbers.

C. viridis L. In flood-refuse and by sweeping Water Mint; common on thistles. (vi, vii, viii, ix.)

Tenebrionidae.

Heledona agaricola Hbst. This beetle occurs in abundance in the 'Sulphur Bracket' fungus (*Polyporus sulphureus*). (iii, v, vii, viii, ix, x.)

Tenebrio molitor L. In yard and workshops of the Crown Estate Office, 2.ix.25, 5.vii.30.

Hypophloeus bicolor Ol. Under elm bark in burrows of *Scolytus destructor*, in burrows of *Dryocoetes villosus* in oak bark, and in wood of decayed beech; not uncommon. (iv, vi, vii, viii.)

H. fraxini Kug. In a burrow of *Tomicus suturellus* in a felled Scots pine pole and in the greatest profusion, with its larvae, under the bark of a number of large felled Scots pines infested by *Tomicus laricis*, *T. suturellus*, etc. (viii, ix, x, xi.)

H. linearis F. By beating cut fir tops and in the burrows of *Tomicus bidens*; rather rare. (v.)

Helops striatus Fourc. In numbers under all kinds of bark. (v, viii, ix, xi, xii.)

Lagriidae.

Lagria hirta L. By sweeping and beating lime trees; not at all common. (vii.)

Cistelidae.

Cistela ceramboides L. By beating hawthorn and oak branches; scarce. (vi, vii.)

C. murina L. By beating elder blossoms and sweeping *Matricaria*; not common. (vi.)

Eryx ater F. Under bark; larvae in numbers in wood-mould of oak, in jackdaw's and other birds' nests. Larvae taken 14.ix.25 and put in nest-refuse, frass, etc., in tin; emerged as perfect insects 20.vi.26. (vi, vii.)

Mycetochares bipustulata Ill. In dry wood-mould in hole in ash tree, in beech stumps, under beech bark and on beech logs, also by brushing in hollow trees; not common. (v, vi, vii.)

Melandryidae.

Tetratoma fungorum F. In decaying fungi on trees, 'Birch Bracket,' 'Sulphur Bracket,' etc.; common and often abundant. (iii, iv, ix, x, xi, xii.)

T. desmaresti Latr. In cobweb, in bits of fungoid oak bark chipped off large tree, etc.; rare. (x.)

Orchesia micans Panz. In 'Poor Man's Beef' fungus (*Fistularia hepatica*), Great Polyporus (*Polyporus giganteus*) and the Dryad (*P. dryadeus*), with its pink larvae; common and often abundant. (vi, vii, viii, ix.)

Clinocara tetratoma Th. By sweeping, beating *Prunus* blossoms, several specimens cut out of a small dead bough; rare. (iv, v, viii.)

C. undulata Kr. In *Polyporus giganteus* on old beech tree; scarce. (ix.)

Hallomenus humeralis Panz. In wood-mould in hole in oak tree, several behind 'Sulphur Bracket' on oak; scarce. (vii, ix.)

Conopalpus testaceus Ol. In boughs and old branches, on felled oak and in old hawthorn, by beating oak and lime trees; not common. (vi, vii, viii.)

Melandrya caraboides L. In hollow beech, on grass stem and on the wing; not common. (v, vi, vii.)

Anisoxya fuscula Ill. By beating and sweeping under lime trees; rare. (vii, viii.)

Abdera bifasciata Marsh. One taken by Miss Kirk on the trunk of an oak; a certain number by beating lime trees. (vi, vii, viii.)

Phloeotrya rufipes Gyll. Under bark of and in oak, beech and ash trees, on felled oaks, etc.; not uncommon. (v, vi, vii, viii.)

Marolia variegata Bosc. 'A single example of this insect is in the collection of the British Museum, captured, I believe, near Windsor' (Stephens, 1832). There is a specimen in the drawer of doubtful British Coleóptera in the British Museum.

Osphya bipunctata F. 'One of these was taken near Windsor in June, 1816' (Stephens, 1832).

O. bipunctata F. var. ♂ *clavipes* Ol. (*anceps* Steph.). 'On whitethorn blossoms; Windsor' (Stephens, 1839).

(To be continued.)

A PRELIMINARY LIST OF THE COLEOPTERA OF WINDSOR FOREST.

BY HORACE ST. J. K. DONISTHORPE, F.Z.S., F.R.E.S., ETC.

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(*Continued from p.* 126)

PYTHIDAE.

Salpingus castaneus Panz. By sweeping, beating hawthorn, fir tops, etc.; common by beating young burnt pines. (v, vi, vii, viii, ix, x.)

S. aeratus Muls. In *Daldinia concentrica* on burnt birch trees; abundant by beating burnt Scots pines. (vii, viii.)

Lissodema quadripustulata Marsh. By sweeping on stack of logs, under elm bark, by beating lime trees; abundant in topmost twigs of ash trees; common. (vi, vii, viii.)

L. kirkae Donis. In the topmost branches of ash trees, also on cut logs; very scarce. (vi, vii, viii.)

Rhinosimus ruficollis L. Under bark of beech, maple, etc.; not uncommon. (vii, viii.)

R. viridipennis Steph. In a puddle, under beech bark and on beech tree; scarce. (v, vii.)

R. planirostris F. In *Hypoxylon fuscum* with its larvae, under beech bark, on logs, by beating faggots, and abundant by beating lime trees; very common. (v, vi, vii, viii.)

OEDEMERIDAE.

Oedemera lurida Marsh. By sweeping flowers, buttercups, etc., and mixed herbage; common. (vi, vii, viii.) Purple coloured specimens occur rarely.

Nacerdes melanura Schmidt. On the wing in the town of Windsor and in forest; running on path; scarce. (vi, vii.)

Ischnomera coerulea L. By beating hawthorn and chestnut blossoms and by sweeping; common. (v, vi.) The green form is not uncommon.

I. sanguinicollis F. In numbers by beating chestnut and hawthorn blossoms; common and very widely distributed. (v, vi.) One specimen dead on leaf, 16.vi.; one just hatched in hole in ash bough, 7.ix.26.

PYROCHROIDAE.

Pyrochroa coccinea L. Larvae frequently under bark of beech trunks. (v, vi.) The perfect insect has not yet been found.

P. serraticornis Scop. On the wing, on grass and in willow-swamp; not common. (v, vi.)

SCRAPTIIDAE.

Scraptia dubia Ol. 'Taken near Windsor — Dr. Leach' (Stephens, 1932).

S. fuscula Müll. 'A single specimen taken in the inside of a hollow decayed beech in Windsor Park, 25.vi.93' (A. J. Chitty). By beating branches and brushing inside hollow trees. A certain number was found in the wood of an old ash bored by, and full of, *A.* (*D.*) *brunneus.* Fowler writes: 'The larva and the perfect insect appear to be, at all events to a certain extent, myrmecophilous.' Several pairs were taken on the wing *in cop.*, 13.vii.27. Not uncommon. (vi, vii.)

MORDELLIDAE.

Mordellistena humeralis L. By sweeping Umbelliferae; scarce. (vii.)

M. neuwaldeggiana Panz. (*brunnea* Fowler). Taken with the preceding; scarce. (vii.)

Anaspis frontalis L. Very abundant by beating hawthorn blossoms. (v.)

A. frontalis L. ab. *flavipes* Donis. By beating Mountain-Ash in flower; scarce. (v.)

A. garneysi Fowler. By beating hawthorn and elder blossoms; not uncommon. (v, vi, viii.)

A. garneysi Fowl. ab. *atra* Donis. By beating hawthorn blossoms; scarce. (v.)

A. pulicaria Costa. By beating hawthorn and sweeping thistles in flower, Umbelliferae and comfrey; common. (v, vi, vii, viii.)

A. rufilabris Gyll. By beating hawthorn, holly, cherry, laurel and *Prunus* blosssoms, also by sweeping; very common. (iv, v, vi, vii.)

A. florenceae Donis. By beating hawthorn, elder, syringa and rhododendron blossoms, and by sweeping comfrey. This appears to be the only known British locality for this distinct species, but it is not uncommon. (v, vi.)

A. geoffroyi Müll. By beating hawthorn, blackthorn and *Prunus* blossoms; common. (iv, v, vi.)

A. geoffroyi Müll. ab. *4-maculata* Costa. On hawthorn blossoms; not uncommon. (v, vi.) The rare ab. *subfasciata* Steph. has not been met with.

A. geoffroyi Müll. ab. *nigra* Donis. By beating flowers of Mountain Ash and hawthorn; not common. (v.)

A. regimbarti Schilsky (*ruficollis* Fowl.). By beating flowers

of syringa, hawthorn, blackthorn, *Prunus*, etc.; very common. (iv, v, vi.)

A. costae Emery (*A. flava* L. var. *thoracica* Fowl.). By sweeping Umbelliferae, especially hog-weed (*Heracleum Sphondylium*); abundant. (viii.)

A. subtestacea Steph. By beating oaks and alders, hawthorn, elder and syringa blossoms, sweeping comfrey, etc.; very abundant. (v, vi, vii, viii, ix.) There are two forms of the female, one with a unicolorous underside and the ordinary form with a black abdomen.

A. maculata Fourc. By beating hawthorn, syringa, rhododendron and elder blossoms; very abundant. (v, vi, vii.)

A. maculata Fourc. ab. *pallida* Marsh. Occurs with the typical form; not uncommon. (v, vi, vii.)

A. latipalpis Schil. ♀ by beating elder blossoms. As no ♂ has yet been taken, this record requires confirmation.

RHIPIPHORIDAE.

Metoecus paradoxus L. A ♀ was taken crawling up a large oak tree, 18.viii.25. This was a curious coincidence. After we had taken the larva of *Velleius* we told the Forester that there was a beetle also found in wasps' nests, and it was just after he had left us that this specimen was found. We have since reared several ♂♂ and ♀♀ from wasps' nests dug up in the district.

ANTHICIDAE.

Anthicus floralis L. By sweeping, in wild honey-bees' comb, in birds' nests; abundant in manure-heaps and haystack bottoms. (v, vii, viii, ix, x, xi.)

A. quisquilius Th. In manure-heaps; much scarcer than the above. (v, vii.)

A. antherinus L. By general sweeping and in willow-swamp; not common. (viii.)

XYLOPHILIDAE.

Xylophilus populneus F. By beating dead branches and twigs on lime trees; scarce. (viii.)

X. brevicornis Perris (*neglectus* Fowler). A single ♂ of this very rare species was taken in frass under beech bark, 12.viii.36.

X. oculatus Gyll. 'Taken near Windsor in July off willows by Messrs. H. G. Griesbach and Waterhouse, from whom I received my specimens' (Stephens, 1832). By brushing in hollow trees, beating oaks, hawthorn, etc., in cells of *A. brunneus*, on the wing, on stacks of wood; abundant on the butts of felled oaks. (vi, vii, viii.)

Meloïdae.

Meloë brevicollis Panz. 'Specimens have been captured near Windsor' (Stephens, 1832).

Anthribidae.

Brachytarsus varius F. By evening sweeping, and sweeping under fir trees, larch, etc.; scarce. (viii, x.)

Choragus sheppardi Kirby. In willow stumps in willow-swamp, under maple bark and on wood stacks; not common. (vi, ix.)

Curculionidae.

Rhinomacer attelaboides F. In sand-pit and in plenty by beating fir tops. (v.)

Attelabus curculionoides L. By beating oaks and Spanish chestnuts, and by sweeping; common. (v, vi, viii, ix.)

Rhynchites caeruleocephalus F. 'The only specimen I have hitherto seen of this beautiful species was captured in the vicinity of Windsor' (Stephens, 1831). There is a specimen from the old B.M. British Collection now in the drawer of doubtful British Coleoptera in the British Museum.

R. aequatus L. By beating hawthorn blossoms; very common. (v.)

R. aeneovirens Marsh. By beating young oaks, birch and sallow; not uncommon. (iv, v.)

R. aeneovirens Marsh. ab. *fragariae* Gyll. Occurs with the typical form; scarcer. (v.)

R. minutus Hbst. By sweeping; not common. (vi, vii.)

R. interpunctatus Steph. By beating wild *Prunus* and hawthorn blossoms and oaks; not common. (iv, v.)

R. nanus Payk. Not uncommon by beating young birches. (v, vii, viii.)

R. uncinatus Th. By beating willows and sallows; not uncommon. (v, vi, vii, viii.)

R. harwoodi Joy. By beating sallows. (vii.) One specimen (Allen).

R. pubescens F. By sweeping; scarce. (v.)

Deporaüs megacephalus Germ. By beating *Clematis* and abundantly by beating birch. (viii.)

D. betulae L. By beating alders and birches; common. (v, vi.)

Apion craccae L. By general sweeping, beating sallows and hawthorn, and in plenty by beating lime trees; common. (iv, v, vi, vii, viii, x.)

A. ulicis Forst. By beating furze (*Ulex europaeus*); common. (v, viii, ix.)

A. miniatum Germ. By sweeping docks, etc.; also in haystack bottoms; not very common. (vi, viii, ix, x, xi.)

A. cruentatum Walt. By sweeping; scarce. (vii.)

A. haematodes Kirby. In moss, by sweeping *Carex* in Sphagnum swamp, sorrel, etc.; common. (vi, vii, viii, ix, x.)

A. fraudator Sharp. By sweeping; scarce. (vii.)

A. brachypterum Sharp. By sweeping wood-sage, etc.; not uncommon. (vii, viii.)

A. rubens Steph. By evening sweeping; not common. (viii, ix.)

A. sanguineum De G. By sweeping wood-sage, etc.; scarce. (vii, ix.)

A. rufirostre F. By sweeping mallows; common. (vii.)

A. difforme Germ. By sweeping, by beating lime trees, and on logs; not common. (v, vi, vii, viii.)

A. dissimile Germ. Under faggots in willow-swamp; scarce. (x.)

A. varipes Germ. In cut grass, grass-tufts, by sweeping and on cut pine tree; not common. (iv, v, vi, vii, ix.)

A. laevicolle Kirby. 'St. Leonard's, near Windsor—Mr. Waterhouse' (Stephens, 1831).

A. apricans Hbst. By beating sallows and sweeping in willow-swamp; not common. (iv, viii.)

A. assimile Kirby. In flood-refuse, in sand-pit and by sweeping; common. (iv, vii, viii, x.)

A. trifolii L. In cut grass, by sweeping melilot, etc.; common. (vi, vii, viii, ix.)

A. dichroum Bedel. By sweeping in willow-swamp, etc., in moss, flood-refuse and by beating crab-apple blossoms; very abundant by beating lime trees. (iv, vi, vii, viii, ix, x, xi.)

A. nigritarse Kirby. By sweeping, in moss, cut hay, haystack bottoms, and abundant by beating lime trees. (v, vii, viii, ix, xi.)

A. stolidum Germ. By sweeping Ox-eye Daisy (*Chrysanthemum Leucanthemum*); very local. (vi.)

A. hookeri Kirby. By sweeping Ox-eye Daisy, etc., but especially Chamomile (*Matricaria Chamomilla*); not common. (vi, vii, ix.)

A. aeneum F. By sweeping mallows; common. (vii.)

A. radiolus Kirby. Common on mallows. (vi, vii, x.)

A. onopordi Kirby. By sweeping vetches, in willow-swamp, etc.; common. (v, vi, vii, viii, ix.)

A. carduorum Kirby. In cut hay, by beating old hawthorn trees, sweeping docks, etc.; common. (v, vi, viii, ix, x, xi.)

A. vicinum Kirby. 'Windsor' (Fowler, 1891).

A. virens Hbst. In flood-refuse, in moss in willow-swamp, in straw in deer-pen, by sweeping, and on clover, eating holes in the leaves; not uncommon. (iv, vi, vii, viii, x, xii.)

A. pisi F. By sweeping; scarce. (vii, ix.)

A. aethiops Hbst. In moss in willow-swamp and by sweeping; not common. (vi, vii, ix, x.)

A. ebeninum Kirby. In flood refuse, in puddle, by sweeping vetches, etc.; rather common. (iv, v, vii, viii, x.)

A. ervi Kirby. By beating lime trees, by sweeping Meadow Pea (*Lathyrus pratensis*), etc.; common. (vi, vii, viii, x, xi.)

A. platalea Germ. (*unicolor* Fowler nec Kirby). By sweeping; scarce. (v, vi, x.)

A. meliloti Kirby. 'Windsor — Mr. Waterhouse' (Stephens, 1831). Abundant by sweeping common Yellow Melilot (*Melilotus officinalis*). (vii.)

A. livescerum Gyll. By sweeping; scarce. (viii.)

A. loti Kirby. By sweeping Comfrey, *Stachys* and vetches, in moss in willow-swamp and in haystack bottoms; very common. (v, vi, vii, viii, ix, x, xi.)

A. tenue Kirby. By sweeping *Melilotus*; scarce. (vii.)

A. simile Kirby. By sweeping and under faggots in willow-swamp; scarce. (vii, viii, ix, x.)

A. pubescens Kirby. By sweeping in willow-swamp; scarce. (viii, ix.)

A. marchicum Hbst. By sweeping in plantations, etc.; common. (v, vi, vii, viii, ix, x.)

A. violaceum Kirby. In flood-refuse, by sweeping rushes, ox-eye daisy, vetches, docks, etc.; common. (iv, v, vi, ix, x.)

A. hydrolapathi Kirby. By sweeping docks; local. (iv, viii.)

(To be continued)

(*Continued from p.* 171)

A. humile Germ. By beating birch, crab-apple, faggots in willow-swamp, and by sweeping ox-eye daisy, dock, wood-sage, etc.; very common. (iv, v, vi, vii, viii, ix, x.)

Otiorrhynchus picipes F. In cut grass, by sweeping; abundant by beating Scots pines. (v, viii, ix.)

O. sulcatus F. Under stones; scarce. (vii.)

O. ovatus L. In moss, cut grass, haystack bottoms, and by beating faggots and sweeping; common. (vi, vii, viii, ix.)

Caenopsis waltoni Boh. By sweeping, and in stool of tree; in numbers in sand-pit. (v, vi, vii, viii, xi.)

Strophosomus coryli F. By sweeping, in reed-refuse, sand-pit, etc.; common. (iv, v, viii, ix.)

S. capitatus De G. By beating young larch trees, and oaks; common. (iv, v, ix.)

S. lateralis Pk. In sand-pit; common sweeping heath and ling. (v, vii, viii.)

Exomias araneiformis Schr. By beating faggots in willow-swamp, in flood-refuse, frass of oak and ash, fern-stack refuse, at roots of trees, under stones, and in sand-pit; abundant. (iv, v, vi, vii, viii.)

E. pellucidus Boh. In sand-pit, and flood-refuse; scarce. (vii, xii.)

Sciaphilus muricatus F. In flood-refuse, and by sweeping; not common. (v, xii.)

Tropiphorus tomentosus Marsh. In sand-pit; scarce. (v.)

Liophloeus nubilus F. By sweeping; scarce. (viii.)

Polydrosus pterygomalis Boh. By beating oaks; not common. (vii, viii.)

P. flavipes De G. 'Windsor Forest' (Fowler, 1891).

P. cervinus L. By beating sallows, birch, aspens, and by sweeping; common. (v, vi, vii.)

Phyllobius oblongus L. By beating hawthorn, elms, etc.; common. (v, vi, vii.)

P. oblongus L. ab *floricola* Hbst. By beating elm; scarce. (vi.)

P. calcaratus F. Abundant on alders. (vi.)

P. urticae De G. By sweeping nettles; common. (v, vi, vii.)

P. pyri L. By beating hawthorn, oaks, etc.; common. (v.)

P. argentatus L. By beating hawthorn blossoms, birch, etc., and by sweeping; common. (v, vi.)

P. maculicornis Germ. By sweeping, beating hawthorn blossoms; abundant by beating birch. (v, vii.)

P. pomonae Ol. By sweeping, grass, rushes, etc.; common, but local. (vi, vii.)

P. pomonae Ol. ab *cinereipennis* Gyll. Occurs with the typical form, but much less common. (vi.)

P. viridiaeris Laich. By sweeping and beating hawthorn; common. (v, vi.)

Tanymecus palliatus F. By sweeping thistles; local and scarce. (vii.)

Atactogenus exaratus Marsh. By sweeping; scarce. (v.)

Barynotus obscurus F. In flood-refuse, and remains in oak frass with *A.* (*D.*) *brunneus*; scarce. (x, xii.)

Alophus triguttatus F. On stacks of wood; scarce. (vi.)

Sitones cinerascens F. In cut grass, moss, sand-pit, at the roots of Bird's-foot Trefoil (*Lotus corniculatus*); not uncommon. (v, vii, viii, ix.)

S. regensteinensis Hbst. By beating gorse and broom; common. (iv, v.)

S. crinitus Hbst. By sweeping; scarce. (vii, xi.)

S. tibialis Hbst. By general sweeping; abundant by sweeping Needle Green-weed (*Genista anglica*). (vi, viii, ix, x.)

S. hispidulus F. In cut grass, under loose hay, and by sweeping; common. (vii, viii, ix, x.)

S. meliloti Walt. By sweeping in lane, and abundant by sweeping melilot; local. (vi, vii.)

S. flavescens Marsh. In cut grass and by sweeping; not common. (vii, ix.)

S. puncticollis Steph. By sweeping; not common. (vii, viii.)

S. suturalis Steph. By sweeping ox-eye daisies, meadow pea and other vetches, etc.; common. (vi, vii, viii.)

S. ononidis Sharp. By sweeping; scarce. (vii.)

S. lineatus L. By sweeping vetches, etc., and by beating birch; common. (iv, v, vi, viii, ix, x.)

S. sulcifrons Thunb. By sweeping in willow-swamp, etc.; not common. (vi, vii, x.)

Gronops lunatus F. In cut grass and in sand-pit; scarce. (v, ix.)

Hypera punctata F. In cut grass, in sand-pit, and by sweeping; not common. (viii, ix.)

H. rumicis L. By sweeping, not common. (vi, viii.)

H. polygoni L. In sand-pit, and by sweeping Persicaria (*Polygonum*); not common. (v, ix.)

H. variabilis Hbst. By sweeping grass, etc.; abundant by sweeping melilot. (v, vii, viii.)

H. murina F. By sweeping, and in haystack bottom; not common. (vii, xi.)

H. plantaginis De G. In cut grass, sand-pit, and on grass stems; not common. (iii, v, viii.)

H. trilineata Marsh. By sweeping; scarce. (vii.)

H. nigrirostris F. By sweeping and beating faggots in willow-swamp; in flood-refuse, by sweeping melilot, etc.; common. (v, vii, vii, xii.)

H. nigrirostris F. ab. *ononinis* Fowler (*nec ononidis* Chevr.). By sweeping; scarce. (vii.)

Liosoma ovatulum Clairv. In moss, and by sweeping; not common. (iv, v, viii.)

L. ovatulum Clairv. v. *collaris* Rye. By sweeping; scarce. (ix.)

Curculio abietis L. (*Hylobius* Schönherr). By beating cut fir-tops, and in sand-pit; not common. (iv, v, viii.) This species had been very common before we commenced to collect in the district, and was very destructive; but immense numbers had been collected by hand and destroyed.

Pissodes notatus F. By beating Weymouth pines, young Scots pines, fir-tops, etc.; also dug out of young burnt pines, and under pine bark; not uncommon, but local. (v, vii, viii, ix.)

Orchestes quercus L. By sweeping, beating crab-apple and hawthorn blossoms; common by beating oaks. (iv, v, vii, viii, ix.)

O. alni L. By sweeping; abundant by beating elm hedges, etc. (iv, v, vi, vii.)

O. ilicis F. 'Windsor' (Fowler, 1891). By sweeping; scarce. (x.)

O. avellanae Don. By evening sweeping, under bark, on felled tree, etc.; not common. (vii, x.)

O. fagi L. By beating *Prunus* blossoms, and abundant on beeches. (iv, v, vi, vii, viii, ix, x.)

O. rusci Hbst. By beating birch, sweeping chamomile, etc.; common. (v, vii, viii.)

O. stigma Germ. By sweeping chamomile, etc.; in sand-pit; common by beating sallows. (v, vi, vii, viii, ix.)

O. salicis L. By sweeping and beating sallows; not common. (iv, viii.)

Rhamphus flavicornis Clairv. By sweeping and beating hawthorn; abundant by beating sallows. (v, vi, vii, viii.)

Erirrhinus acridulus L. On mud round ponds, and by sweeping in swamps, etc.; not uncommon. (iv, v, vi, viii, ix.)

Thryogenes festucae Hbst. By sweeping reeds, etc., in marshy places; not common. (vi.)

T. nereis Payk. Under the same conditions as the above and more common. (v, vi.)

T. scirrhosus Gyll. One specimen by sweeping reeds, etc., round pond; 26.viii.31.

Dorytomus vorax F. In and under bark of cut-down poplars; local and scarce. (xi.)

D. tortrix L. By beating hawthorn; not uncommon by beating aspens. (v, vi.)

D. maculatus Marsh. By beating maple tree in bloom and hawthorn; abundant by beating sallows. (iv, v, vi, vii.)

D. maculatus Marsh. v. *costirostris* Gyll. 'Windsor Forest' (Fowler, 1891). On young aspens; scarce. (iv.)

D. maculatus Marsh. v. *silbermanni* Wenck. In grass tufts; scarce. (iv.)

D. melanophthalmus Payk. By beating sallows; not uncommon. (iv, vi, x, xi.)

D. melanophthalmus Payk. v. *agnathus* Boh. Generally in company with the typical form; but less common. (iv, v, x.)

D. pectoralis Gyll. By sweeping, by beating hawthorn; abundant by beating sallows. (iv, v, vi, vii, ix, x, xi.)

Smicronyx jungermanniae Reich. One specimen by beating firtops! 3.v.36. Its proper habitat is on the lesser Dodder (*Cuscuta epithymum*) on furze and heath. At Windsor we have tried this without success.

Tanysphyrus lemnae F. In moorhen's nest, by sweeping Great Water-Plantain (*Alisma plantago*), on Duck-weed (*Lemna minor*); common in moss from dry pond. (vii, viii.)

Bagous alismatis Marsh. One specimen in a moorhen's nest 6.vii.32. The Water-Plantain has been swept and searched without success.

B. lutulosus Gyll. One specimen by sweeping White Sedge (*Carex canescens*) in *Sphagnum* swamp 9.v.36.

Anoplus plantaris Naez. By sweeping in plantations, camomile, etc., and by beating hawthorn, sallows, birch; not uncommon. (v, vii, viii, ix.)

Elleschus bipunctatus L. By beating sallows, sometimes in numbers; local. (iv, v.)

Tychius meliloti Steph. Abundant by sweeping melilot (vii, x.)

T. tomentosus Hbst. By sweeping ox-eye daisies; scarce. (vi.)

Miccotrogus picirostris F. In flood-refuse, moss in willow-swamp, by beating Scots pine, and by sweeping Tormentil (*Potentilla Tormentilla*), reeds, etc.; very common. (v, vi, vii, viii, xii.)

Sibinia potentillae Germ. By beating hawthorn and sweeping chamomile; scarce. (v, vii.)

S. primita Hbst. By sweeping; scarce. (viii.)

Miarus plantarum Germ. By sweeping rather short grass; scarce. (vi, vii.)

Gymnetron veronicae Germ. v. *nigrum* Walt. (*beccabungae* Fowler *nec* L.). By sweeping; scarce. (vii.)

G. plantaginis Epp. One specimen by general sweeping 10.vi.38.

G. rostellum Hbst. 'Windsor Forest' (Fowler, 1891).

G. lloydi Donis. One specimen of this very distinct species was swept off Garlic Mustard (*Alliaria officinalis*) 19.vi.29.

Mecinus pyraster Hbst. In hole in topmost twig of ash tree, by beating *Clematis*, and by general sweeping; not uncommon. (iv, v, viii, x.)

Anthonomus ulmi De G. By sweeping and beating elms, etc.; abundant (many dark abs.), also by beating hawthorn trees in winter. (vi, vii, x, xi, xii.)

A. rosinae Des Gozis. By sweeping; scarce. (vi.)

A. pedicularius L. By beating lime trees, and sweeping; abundant by beating hawthorn. (iv, v, vii, viii, xi.)

A. pomorum L. By beating hawthorn and blackthorn blossoms; more abundant by beating crab-apple blossoms. (iv, v, vi.)

A. rubi Hbst. In moss and by sweeping in willow-swamp, and general sweeping; common. (vi, vii, viii, ix.)

A. comari Crotch. By sweeping; scarce. (vii, viii.)

Nanophyes lythri F. By sweeping in willow-swamp; not uncommon but very local. (vi, vii, viii, ix.)

Cionus scrophulariae L. By sweeping Fig-wort (*Scrophularia aquatica* and *S. nodosa*); common. (v, vii, viii, ix.)

C. tuberculosus Scop. By sweeping fig-wort; very local and scarce. (ix.)

C. hortulanus Marsh. Common by sweeping fig.-wort. (v, vi, ix.)

C. blattariae F. By sweeping fig-wort; not common. (v, vii, viii, ix.)

C. pulchellus Hbst. Not uncommon by sweeping fig-wort. (v, vii.).

Orobitis cyaneus L. By general and evening sweeping; scarce. (v, viii.)

Acalles ptinoides Marsh. In sand-pit, by sweeping under fir trees, and on twigs on nests of *Formica rufa;* not common. (v, vii, viii, ix.)

A. turbatus Boh. By sweeping; scarce. (vii.)

Coeliodes rubicundus Hbst. By beating oak and birch; not common. (v, vi, vii, viii.)

C. quercus F. In flood-refuse, by beating fir tops, oaks, birch, sallows, blossoms of *Prunus* and hawthorn; common. (iii, iv, v, ix.)

C. ruber Marsh. By beating birch and oak; scarce. (iv, v, vii.)

C. erythroleucus Gmel. By sweeping in plantations, and beating oaks, birch, and *Prunus* blossoms; common. (iv, v, vii, viii, ix.)

C. cardui Hbst. By sweeping; not common. (v, vii, x.)

C. quadrimaculatus L. Abundant by sweeping nettles. (v, vi, vii, viii, ix, x.)

Poophagus sisymbrii F. Very local, but not uncommon by sweeping Marsh Yellow Cress (*Nasturtium palustre*). (vi.)

Ceuthorhynchus assimilis Payk. By sweeping Shepherd's Purse (*Capsella Bursa-pastoris*), Hedge Mustard (*Sisymbrium officinale*), Garlic Mustard (*Alliaria officinalis*), Marsh Yellow Cress, etc.; common and widely distributed. (v, vi, vii, viii.)

C. constrictus Marsh. By sweeping Garlic Mustard, Hedge Mustard, ox-eye daisies, etc.; common. (v, vi, vii.)

C. cochleariae Gyll. On oak fence, by sweeping 'Milk-maids' (*Cardamine pratensis*) ; not uncommon. (iv, v, vi.)

C. ericae Gyll. On mud round pond, by sweeping heather (*Erica cinerea*); not uncommon. (vi, vii, viii.)

C. erysimi F. By beating faggots, in grass tufts, and by sweeping Hedge and Garlic Mustard; common. (iv, vii, viii.)

C. erysimi F. ab. *chloropterus* Steph. By sweeping Garlic Mustard in company with the typical form, but far less common. (vii.)

C. contractus Marsh. By sweeping Comfrey (*Symphytum officinale*), Chamomile (*Matricaria*), Hedge Mustard, in moss, in willow-swamp, etc.; very common. (v, vi, vii, ix.)

C. chalybaeus Germ. Abundant by sweeping Hedge Mustard. (vi, vii.)

C. hirtulus Germ. In moss in willow-swamp; scarce. (x.)

C. quadridens Pz. By sweeping rushes, Hedge and Garlic Mustard; not common. (vi, viii.)

C. pollinarius Först. By sweeping nettles. (v.) We appear to have only once taken this very common insect in this area.

C. picitarsis Gyll. Sweeping Garlic Mustard, and Field Pepperwort (*Lepidium campestre*); not common. (vi, vii.)

C. pleurostigma Marsh. By beating *Prunus* blossoms, and by sweeping Chamomile, *Polygonum Persiçaria*, etc.; abundant. (iv, v, vi, vii, viii.)

C. alliariae Bris. By sweeping Garlic Mustard; not common. (vi.)

C. rugulosus Hbst. In moss in willow-swamp and by sweeping Chamomile; common. (v, vii.)

C. melanostictus Marsh. In moss in willow-swamp, etc., and by sweeping Water Mint (*Mentha hirsuta*); not uncommon. (iii, v, vi, vii, viii, ix.)

C. chrysanthemi Germ. Common by sweeping Ox-eye Daisies (*Chrysanthemum Leucanthemum*. (vi.)

C. litura F. By sweeping Figwort, but chiefly on thistles; not uncommon. (vi, vii, viii, ix.)

Ceuthorhynchidius floralis Payk. In flood-refuse, grass-tufts, in moss, by beating faggots in willow-swamp, and by sweeping many species of *Cruciferae*; very common. (iv, v, vi, vii, ix, xii.)

C. palustre Edmonds. By sweeping Marsh Yellow Cress (*Nasturtium palustre*) in willow-swamp; very local and scarce. (vii.)

C. pyrrhorhynchus Marsh. By sweeping Garlic Mustard and common by sweeping Field Pepper-wort. (vi, vii, viii.)

C. melanarius Steph. By sweeping reeds, etc., and Water-cress (*Nasturtium officinale*); not common. (vi, vii, viii.)

C. troglodytes F. By beating faggots in willow-swamp; abundant by general sweeping. (v, vi, x.)

C. rufulus Dufour. One specimen by sweeping in willow-swamp, 19.x.29. Usually confined to the coast.

Amalus haemorrhous Hbst. By sweeping grass; scarce. (vi.)

Rhinoncus pericarpius L. By sweeping wet grass, docks, Persicaria, etc.; abundant. (v, vi, vii.)

R. gramineus F. By sweeping rushes and damp grass; very abundant by sweeping Amphibious Persicaria (*Polygonum amphibium*). (vi, ix.)

R. perpendicularis Reich. Abundant by sweeping *Persicaria*. (v, vi, vii, ix.)

R. castor F. In sand-pit; abundant by sweeping coarse grass. (v, vi, vii, viii.) A specimen was observed to jump, 9.vii.35.

Phytobius comari Hbst. In moss in willow-swamp; scarce. (v, vi.)

P. waltoni Boh. By sweeping in marshy places; in numbers by sweeping a species of Persicaria. (v, viii.)

P. quadrituberculatus F. On mud round pond; scarce. (vi.)

P. canaliculatus Fåhr. By sweeping reeds and water-mint; not common. (vii, viii.)

P. quadrinodosus Gyll. (= *Rhinoncus denticollis* Fowler). 'Windsor Forest, rare — S. Stevens' (Fowler, 1891).

Limnobaris t-album L. By sweeping; scarce. (vii.)

L. pilistriata Steph. Abundant by sweeping *Carex* in *Sphagnum* swamp. (vi, vii.)

Balaninus venosus Germ. By sweeping and beating hawthorn; not common. (v, vi.)

B. turbatus Gyll. By sweeping and beating oaks; not uncommon. (vi, vii, viii, ix.)

B. betulae Steph. By sweeping in a plantation of birch, fir and oak; scarce. (vii, viii, ix.)

B. rubidus Gyll. By sweeping in the same plantation as above; not uncommon. (vii, viii, ix.)

B. villosus F. On trunks of trees and by beating; not common. (iv, v, vi.) It has not been seen since 1928. An aberration clothed with yellow instead of grey hair taken on an oak tree, 6.vi.24.

B. salicivorus Payk. By sweeping and beating sallows; common. (v, vi.)

B. pyrrhoceras Marsh. By beating sallows, oaks, hawthorn, sweeping reeds, etc.; common. (v, vi, vii.)

Calandra granaria L. A specimen was taken in the wood-mould of a hollow ash tree, 3.ix.24. Possibly introduced in pheasant food.

Dryophthorus corticalis Payk. This genus and species new to Britain, which was discovered by Miss Kirk and myself in numbers in damp, tough wood inside an oak infested by the ant *A.* (*D.*) *brunneus* on 9.vii.25, occurs in abundance in such situations. A few isolated specimens have been found on oak trunks, a gate post, etc. The last seen was resting on the stack of elm logs (where *Gastrallus laevigatus* was first discovered), 21.vii.36.

Cossonus ferrugineus Clairv. In large numbers (many dead), and larvae and pupae, in wood-mould and soft wood in the centre of a large felled poplar tree, and at roots of other felled poplars. (vi, viii, xi.)

Rhyncolus lignarius Marsh. 'Windsor' (Fowler, 1891). In jackdaw's and other birds' nests, at sap on abraded bark, under bark of ash and elm, very abundant in rotten wood of maple trees, and bred in numbers from thick ivy stems. (iv, v, vii, viii, x, xi.)

Stereocorynes truncorum Germ. In 'Dryad' fungus, in some numbers in roots, frass, etc., of oaks infested by *A.* (*D.*) *brunneus*; abundant in ash tree in company with the same ant. (ii, vi, vii, viii, x, xi.)

Magdalinus armigera Fourc. By sweeping under trees and by beating hawthorn; bred in abundance from a small oak bough. (iv, v, vi.)

M. cerasi L. By beating Mountain Ash and hawthorn blossoms, sweeping in mixed plantation, etc.; not uncommon. (v, vi, vii, viii.)

M. pruni L. By beating hawthorn blossoms and branches; not uncommon. (v, vii.)

M. barbicornis Latr. By beating hawthorn blossoms and by beating and sweeping under hawthorns; not common. (v, vi, vii.)

Scolytidae.

Scolytus destructor Ol. Abundant in bark of elms, felled elms, elm branches, etc. (vi, vii, viii, ix.) Infesting a live standing elm tree, 7.ix.33.

S. pruni Ratz. By beating and under bark of hawthorn; scarce. (vii, viii.)

S. intricatus Ratz. By evening sweeping, on wood-stacks, in beech and oak boughs; bred in numbers from oak boughs. (v, vi, viii, ix.)

S rugulosus Ratz. On cherry tree and abundant by beating old hawthorn trees. (vii, viii.)

S. multistriatus Marsh. Abundant in elm-bark. (v, vi, vii, viii, ix.)

Hylastes attenuatus Er. In sand-pits, by beating fir tops, flying over felled Scots pine, and in some numbers in and under Scots pine bark. (v, viii, ix, xi.)

H. ater Payk. Under the same conditions as above; commoner and more widely distributed. (iv, v, viii, xi.)

H. opacus Er. In sand-pit; scarce. (iv.)

H. palliatus Gyll. In larch branches, under spruce and fir bark and by beating burnt pines; not uncommon. (iii, v, vii, viii, ix.)

Hylesinus crenatus F. In bark of ash trees and stumps; not uncommon. (v, vi, vii.)

H. oleiperda F. By beating dead ends of ash twigs and in some numbers in the topmost branches of ash tree. (vii.)

H. fraxini Panz. By beating fir tops and hawthorn, in bark of ash; common on the wing and settling on ash logs. (v, vi, vii.)

H. vittatus F. On the wing; scarce. (v.)

Myelophilus piniperda L. By beating fir tops and burnt pines; common in and under Scots pine bark. (v, ix, x.)

M. piniperda L. ab. *rubripennis* Reitt. On the wing and by beating burnt pines; scarce. (iv, viii.)

Phloeophthorus rhododactylus Marsh. On and under Scots pine bark; scarce. (v.)

Cryphalus fagi Nord. By beating oak, and in abundance in dead branches and in small topmost branches of beech trees. (v, viii, ix.)

Pityophthorus pubescens Marsh. By evening sweeping, in topmost twigs of Scots pine, and by beating fir tops; abundant by beating young burnt Scots pines. (v, vii, viii, ix.)

Xylocleptes bispinus Duft. By beating stems of Traveller's Joy (*Clematis Vitalba*); very local. (viii.)

Dryocaetes villosus F. In oak tree with *A.* (*D.*) *brunneus*, in and under bark of chestnut and oak; common and abundant. (iii, iv, v, vi, vii, viii.) Males and females may be found in pairs in fresh burrows in oak bark.

Tomicus laricis F. By beating burnt pines, in and under bark of larch and spruce; abundant in all stages in and under bark of felled Scots pines. (iii, v, vii, viii, ix.)

T. nigritulus Gyll. This northern species, which was formerly regarded as very rare, occurs under bark of cut fir poles, and in and under the bark of felled Scots pines; abundant under the bark of fallen spruce trees (Kirk and Donisthorpe), 24.iii.33; common. (iii, iv, viii, xi.)

Pityogenes bidentatus Hbst. By sweeping, on fir logs, not uncommon by beating fir tops; abundant by beating young burnt Scots pines. (v, vii, viii, ix.)

Trypodendron domesticum L. In crevice in felled beech, on the wing, flying over beech logs, and under beech bark; not uncommon. (iii, iv, vii.)

Xyleborus dispar F. On the wing and on sappy oak stumps; in numbers, all females, in hard oak stumps. (v.)

X. dryographus Ratz. On butts of felled trees, on oak logs, beech stumps and under beech bark; not uncommon. (vi, vii.)

X. saxeseni Ratz. On oak fence, sappy oak stumps, felled beeches and oaks; abundant in and under beech bark. (iii, v, vi,

vii, ix.) Very abundant by beating and sweeping, on the wing and on timber, over a large area, 5.v.35.

Platypus cylindrus F. On and under bark of oak and beech logs and stumps; very abundant. Numbers of specimens may be seen flying to, crawling over and burrowing in freshly felled beech and oak trees. The beetles may be found in plenty by the frass outside the burrows where they have entered the bark of the felled trees. (iv, vii, viii.)

(To be concluded.)

(Concluded from p. 222.)

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SUPPLEMENT.

The majority of the species in this Supplementary List have been taken during the time the main list was in course of publication; a few, however, were omitted by mistake.

The complete list now includes upwards of 1,870 species, besides 87 aberrations and varieties. Some of these, such as *Bembidium 4-pustulatum* Dej. and *Aulonium trisulcum* Geoff., etc., have increased enormously in numbers in the last few years; others have become very rare and have not been met with for a long time in the Forest.

Two rather striking flies, both new to Britain, have been recently captured in Windsor Forest. The first, a large Asilid, *Laphria gilva* L., was taken by Mrs. Blair at rest on a Scots Pine trunk; further specimens were subsequently taken by Dr. Blair, the Rev. C. Tottenham and the writer in the same place.

The other, a very pretty fly, *Chrysopilus laetus* Zett. was reared from a puparium taken by me in the mud round a pond. *C. laetus* is not represented in the British Mus. Coll. and the Windsor specimen may prove to be a new species. [Subsequently determined by Dr. Lindner of Stuttgart as *C. nubecula* Fallén.]

Carabidae.

Stenolophus teutonus Schr. Running on mud round pond; scarce. (vii.)

Badister sodalis Dufts. Under stones in willow-swamp; scarce. (vii.)

Harpalus seladon Schaub. (*rufibarbis* Fowler in part). By sweeping; not common. (vii.)

Pristonychus terricola Hbst. At roots of tree and under board in a sandy place; scarce. (viii.)

Anchomenus piceus L. Running on mud in damp place; scarce. (viii.)

Bembidion lampros Hbst. ab. *velox* Er. On mud round pond and under stones in damp place; not common. (vi.)

B. obliquum Sturm. Under stones in damp place; scarce (Blair). (vi.)

Metabletus truncatellus L. One under dead leaves (iii) (Allen).

STAPHYLINIDAE.

Oxypoda lentula Er. In flood-refuse and in willow-swamp; not common. (iii, vi.)

O. exigua Er. By sweeping sedge round mere; scarce. (vii.)

O. misella Kr. Under bark of beech root, one specimen (Allen). (vi.)

Calodera umbrosa Er. In moss in willow-swamp (x); one specimen under dead bird. (vi.)

Atheta occulta Er. In fungi, straw-refuse, owl's nest, etc.; not uncommon. (iv, v, vi.)

A. angustula Gyll. In flood-refuse, by sweeping round mere, etc.; not common. (iii, x.)

A. subdebilis Joy (=*nannion* Joy). In flood-refuse (Allen). (iii.)

A. xanthopus Th. In fungi; scarce. (vi.)

A. perexigua Sharp. In straw, fern-stack refuse and owl's nest; scarce. (iv, vi, vii.)

A. subtilis Scriba (*indiscreta* Sharp). In the 'Dryad's Saddle' fungus; scarce. (ix.) The only other *English* record for this species is Sherwood Forest (Blatch).

A. scapularis Sahlb. By evening sweeping; scarce (Allen). (vi.)

Tachyusa atra Gr. In wet moss in willow-swamp, on mud round ponds; scarce. (vi, vii, viii.)

Conosoma bipunctatum Er. Under bark of a rotten log; scarce (Allen). (vi.)

Velleius dilatatus F. An adult specimen was taken at the base of a bunch of dry fungi, 21.vii.38. Only the larva had been taken previously. See main list.

Achenium humile Nic. At roots of grass round elm post, also in company with *A. depressum* Grav.; not common. (ii, iv.)

Cryptobium brevipenne Muls. & Rey. All the Windsor specimens of *Cryptobium* are to be referred to this species and not *C. glaberrimum* Hbst., as recorded in the main list.

Paederus littoralis Grav. Running on stack of wood and on logs. This common species is very scarce here. (iii, viii.)

P. riparius L. By sweeping sedge round mere; scarce. (vi.)

Evaesthetus scaber Grav. In moss; scarce (Allen). (iv.)

Bledius fracticornis Payk. In the main list. Running on and in mud round pond, also in burrows in a damp place; not common. (vi, vii.)

Oxytelus clypeonitens Pand. One by sweeping (Allen). (vii.)

Acrognathus mandibularis Gyll. Under stone in a damp place (Blair). (vii.)

SILPHIDAE.

Agathidium convexum Sharp. In fungus on old stump; very scarce. (vii.)

Cyrtusa pauxilla Schm. By evening sweeping; very scarce (Allen). (vi.)

SCYDMAENIDAE.

Neuraphes angulatus Müll. In moss; scarce. (vii.)

PSELAPHIDAE.

Bythinus securiger Reich. One specimen in moss in willow-swamp (Allen). (ii.)

TRICHOPTERYGIDAE.

Trichopteryx bovina Mots. Often under dry horse- and cow-dung on roads, etc. (viii.)

T. brevipennis Er. In 'Sulphur Bracket' fungus, etc.; scarce. (ix, x.)

Nephanes flaviventris Mots. In fern-stack refuse; fairly common. (vi, vii, viii.) This species has not apparently been recorded from Britain, although there is a series from Matthews' collection without locality in the British Collection in the British Museum (Nat. Hist.) separated by I. B. Ericson from the series of *N. titan* Newm. Matthews gives Central America as the locality for *N. flaviventris* Mots., though there is a specimen from Algeria in the British Museum.

COCCINELLIDAE.

Halyzia 12-guttata Poda. 'Rare: I possess a fine series of which the greater portion were taken in the years 1815-16 in Windsor Forest'—Stephens (1831) (*sub Coccinella bissexguttata* Illiger). There are five specimens in the Stephensian collection. 'The only specimen I have seen was a pinned one in Griesbach's collection, now in the possession of Mr. Mason'—Fowler (1888).

Scymnus testaceus Mots. This is the typical form of *S. scutellaris* Muls. mentioned in the main list. By sweeping round mere; scarcer than the ab. (ix.)

HISTERIDAE.

Hister carbonarius Ill. This is the species mentioned twice (as *H. cadaverinus*), the second time as *cadaverinus* Illiger.

Acritus atomarius Aubé. In burrows of *Dorcus* in beech; one specimen, 23.i.38.

NITIDULIDAE.

Rhizophagus nitidulus F. Not uncommon under bark of oak stumps; local. (iii.)

LATHRIDIIDAE.

Melanophthalma similata Gyll. By beating spruce and in frass of tree; scarce. (iii, ix.)

CRYPTOPHAGIDAE.

Cryptophagus badius Sturm. In *Hypoxylon fuscum* and a dozen specimens in loose straw. (x.)

Atomaria gutta Steph. In moss in willow-swamp (Allen). (iii.)

Atomaria versicolor Er. Under dry dung, one specimen (Allen). (vii.)

PARNIDAE.

Elmis aeneus Müll. One by sweeping grass. I have never been able to find it in its proper habitat under stones in streams. (vi).

SCARABAEIDAE.

Onthophagus vacca L. A thorax of this species found in a bird's nest (ix) (Allen).

DASCILLIDAE.

Cyphon coarctatus Panz. 'Taken near Windsor' (Stephens, 1832). By sweeping reeds, etc., in damp places; not uncommon. (vi, viii, ix.)

CERAMBYCIDAE.

Strangalia melanura L. By general sweeping and beating bramble-blossoms; not uncommon. (vi, vii.)

CHRYSOMELIDAE.

Chaetocnema aridula Fourc. In fair numbers by sweeping tussocks of grass; very local. (ix, x.) This is the insect recorded as *C. confusa* in the main list.

TENEBRIONIDAE.

Alphitophagus 4-pustulatus Steph. One on a cut beech bough (vi) (Allen).

CURCULIONIDAE.

Apion affine Kirby. Under dead bracken in sand-pit; very scarce. (x.)

Trachyphloeus aristatus Gyll. One specimen in a small sand-pit. (vii.)

T. squamulatus Ol. One specimen in the same sand-pit (Allen). (vii.)

Tychius junceus Reich. One specimen by sweeping (vi) (Allen).

British Museum (Natural History),
Cromwell Road, London, S.W.7.
November, 1938.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiv.

Records of Worcestershire Orthoptera.—Dr. Malcolm Burr, in his book (British Grasshoppers and their Allies, London, 1936, p. xii), remarks upon the scarcity of records of Orthoptera from the Midland Counties, particularly Shropshire and Worcestershire, from which apparently no Orthoptera had ever been recorded up to the preparation of this work. It seems desirable therefore to publish the following records of Worcestershire Acridiidae collected during August Bank Holiday week-end, 1938, chiefly by the roadside.

Chorthippus bicolor (Charp.), near Pershore, 31.vii.1938, and near Holt Heath, 31.vii.1938. (There is also a specimen in the Lucas Collection in the Oxford University Museum labelled 'Great Malvern, Sept., 1906, E. Lucas.') *Ch. parallelus* (Zett.), near Holt Heath, 31.vii.1938, and near Feckenham, 1.viii.1938. *Ch. albomarginatus* (De Geer), near Pershore, 31.vii.1938.—Ernest Taylor, Oxford University Museum: *August 15th*, 1938.

A

SETODES LUSITANICA McL.: A CADDIS-FLY NEW TO BRITAIN.

BY THE REV. PROFESSOR L. W. GRENSTED, M.A., D.D., F.R.E.S.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiv.

On July 1st I took a single specimen of this species on one of the main concrete columns supporting the bridge over the Thames at Goring. During the following week I took six more specimens, and it is obvious that the species is there in some numbers. It is mainly to be found on and about the big willows on the island in the middle of the stream, and as these are very inaccessible it is not likely to suffer much from collectors. This species, described in 1884, and taken by Mr. M. E. Mosely in some numbers in France and Corsica, is new to the British list of Trichoptera.

May I take this opportunity of recording also the occurrence of *Stenophylax rotundipennis* Brauer, of which my son last year took six or seven specimens in the Oxford district. This should be looked out for by collectors in September along the Thames valley. It is one of the rarest European species, and there is hardly a definitely known locality for it. It would be interesting to know whether it has a wide distribution in the Thames valley. I can also add another locality for *Metalype fragilis* Pict., which occurred in large numbers last year at Bourton-on-the-Water, Gloucestershire.

32 Charlbury Road,
Oxford.
July 7th, 1938.

Setodes lusitanica McL. in Oxfordshire.—On July 9th I collected about half a dozen specimens of *Setodes lusitanica* McLach. (just added to the list of British Trichoptera by the Rev. L. W. Grensted, *vide antea*) resting on herbage by the side of the Thames near Dorchester, and also near the Shillingford Bridge. A second visit to the former locality during the evening of July 11th produced further odd specimens, until about 8 p.m., when the *Setodes* began to fly in swarms. Paired specimens could now be found resting, and the swarming was observed at the margin of the water, and over the edges of the bordering fields, for about a quarter of a mile down the river, and was probably taking place along a great portion of its length. Occasionally there were intervals of from fifteen to thirty minutes in the swarming, possibly due to changes in the weather conditions, but always the caddis-flies reappeared, until I left at about 10 p.m.—EDWARD W. AUBROOK, University Museum, Oxford: *July 18th*, 1938.

Reprinted from 'The Entomologist', Vol. LXX, August, 1937.

FURTHER NOTES ON THE LEPIDOPTERA OF CARA ISLAND.

BY W. H. DOWDESWELL.

Two years ago Mr. G. H. Swynnerton, Mr. W. N. Paton and I paid a visit to the island of Cara for the purpose of obtaining information concerning its Lepidoptera (Dowdeswell, 1936). Last summer I decided to revisit it in company with Mr. W. D. Paul, with the idea of following up some of the more interesting data collected on the former occasion.

As previously described, Cara is a small island about one mile long and half a mile wide, being one mile due south of the island of Gigha, and about 3½ miles west of Tayinloan on the mainland of the Mull of Kintyre. The main vegetation of the island, which incidentally is completely wind-swept, consists of grasses, bracken, heather, and a certain amount of rushes and irises in the more low-lying and damper places. We spent fifteen days on the island, from July 17th to August 1st, thus arriving there a little more than two weeks later than on the previous year.

Concerning our work on Cara, I should first like to add 13 more species of moths to our list of 22 captured there last year, thus bringing the total number of Lepidoptera recorded up to 45—10 species of butterflies and 35 species of moths. The 13 additional species which we caught this year are as follows:

Lasiocampa quercus, var. *callunae*; *Agrotis exclamationis*; *Noctua c-nigrum*; *Noctua xanthographa*; *Triphaena pronuba*; *Apamea secalis*; *Xylophasia rurea*; *Xylophasia lithoxylea*; *Phlogophora meticulosa*; *Leucania pallens*; *Caradrina cubicularis*; *Xanthorhoë montanata*; *Crocallis elinguaria*.

Lasiocampa quercus was found as a young larva, which unfortunately died before attaining the pupal stage. By far our most interesting capture was a single normal specimen of *Caradrina taraxaci*. On our previous expedition the only *Caradrina* caught was a very remarkable melanic form with fore wings almost black, and hind wings of a somewhat lighter colour tinged with brown. The only previous record of such a specimen that I could find was in Barrett (1895), who describes a similar individual in the collection of Mr. S. Stevens. We also took 6 specimens of *Arctia caia* with the intention of making a comparison with those caught last year in

respect of wing markings. Unfortunately they were extremely worn and obviously nearly over when we arrived. Those we took showed no particular variation in wing marking, either when compared with one another, or with the 20 specimens taken last year.

The remainder of our work was confined entirely to a detailed study of *Xylophasia monoglypha*, and in this connection it will be best to set out our observations under two different headings.

1. Xylophasia monoglypha Eaten by Rats.

This rather extraordinary series of observations started on the evening of July 26th, when, doing our rounds of sugar patch collecting at 11.15, we found, as on several previous nights, no moths on a certain sugared piece of board, which had been driven into the ground, giving a sugaring surface about a foot high. But on this night, although there were no moths, we found the four wings of a *Xylophasia monoglypha* lying as if they had been torn from the body of the insect at the foot of the board. By their freshness it was apparent that they had been removed not long before; they had certainly not been there at 9 o'clock when we had done our round of sugaring. Before proceeding I should mention that on previous nights, whenever we had taken moths on this particular board, or others in its vicinity, nothing but *Xylophasia monoglypha* had ever been recorded. On July 27th we decided to keep watch on this board, and having done our sugaring round as usual at 9 o'clock, started our vigil at 10.35, just as it was getting dark. Lying down in the grass about 10 yards away, at 10.45 a large rat was observed approaching the sugared board from behind, *i. e.* coming towards the non-sugared side, moving by quick and rather stealthy runs of a few yards at a time, giving us the impression that it was stalking something. Eventually it reached the board where there were two *monoglypha* feeding, and standing up on its hind legs with its front legs against the back of the board, put its head round the left side of the board and seized one of the moths, the crunching noise as the chitinous body of the insect was chewed being quite audible to us. Having devoured its prey at the foot of the board the rat departed in the direction from which it had appeared. Examination of the ground at the foot of the board immediately afterwards showed that the four wings of *monoglypha* had been left, but there were no visible signs of any other part of the anatomy of the moth.

On the following day we nailed the same board to a post which had been driven into the ground, thus giving a height of about 4 ft. in all to the top of the board. As before, we sugared the board on the same side, and arranged it so that the sugared surface faced

the same way as on the two previous nights. In doing this, we though it would be interesting to determine if possible to what lengths the rat would go in order to secure *monoglypha* as food. As on the previous night, we started watching at 10.45, and on this particular night it was rather dark. At 10.55 we saw a rat approaching the board, coming this time from the opposite direction, *i. e.* towards the sugared side of the board, where there were several *monoglypha* feeding. On getting to the board the rat appeared purposely to go round to the other side, *i. e.* the non-sugared side, and then proceeded to climb the post on that side. In doing this it must have alarmed the moths, for when it put its head round the side of the board as on the previous night all the *monoglypha* had gone. The rat then descended the post again, and went off in the opposite direction to the one from which it had come. Owing to the darkness, and also to the large number of rats in that particular part of the island, it was, of course, quite impossible to tell if it was the same or a different rat that we observed on those two successive nights. Further observations were unfortunately frustrated by extremely bad weather, which seemed to affect the rats very much more than the *monoglypha*, for although we caught small numbers of the latter on very stormy nights, we never saw another rat, even at our rubbish pit, which was generally a happy hunting-ground for them.

2. Population Numbers and Melanism.

On our previous expedition we were extremely fortunate in collecting information concerning the distribution of *Xylophasia monoglypha* on Cara which, this year, proved to be invaluable to us. We found that this moth has a remarkably local distribution on the island, for it failed to occur at the extreme north and south ends: further it appeared to be very scarce on the low ground to the east. However, when one remembers that the food of the larvae is *Poa annua* and other grasses this localization is hardly surprising, since the predominant vegetation in the parts from which it is absent consisted of bracken, heathland, and bracken and rushes respectively. Thus, nearly the whole of the population seemed to be confined to an almost rectangular area of about 110,450 square yards, and the most easterly border running approximately 470 yards north and south, and lying slightly to the east of the middle of the island. To the west the locality stretched for 235 yards, to within a short distance of high-water mark. This information simplified the task of sugar-collecting enormously, and we found that we could cover the area satisfactorily with 22 sugar patches. Wherever possible we chose the sides of rocks, as these

seemed to be preferred by *monoglypha,* but when these were not available, pieces of boarding were employed.

In order to estimate the total numbers of *Xylophasia monoglypha* on Cara, we employed a method suggested by Mr. E. B. Ford. The moths were put in pill-boxes, and each one was then classified according to its colour and sex. A fore wing of each individual was then "clipped" with a ticket puncher, thus making a small round hole which, however, did not seem to impede the flight of the insect in the least. When this had been done the moths were liberated, always on the morning after the night on which they had been captured. Each time that an individual was recaptured, one more hole was made in its wings. In this way each moth bore a permanent record of the number of times that it had been captured. We were thus able to compile a list of data, comprising the total number of moths caught, also the number of these recaught once, twice, etc., From this the following results were obtained :

Colour No.	Males.	Females.	Total.
(Melanic) 8	21 (6·3%)	36 (11·5%)	57
7	55 (16·5%)	50 (16 %)	105
6	58 (17·4%)	66 (21·1%)	124
5	54 (16·2%)	82 (26·2%)	136
4	62 (18·6%)	43 (13·8%)	105
3	21 (6·3%)	12 (3·8%)	33
2	31 (9·3%)	7 (2·2%)	38
(Non-melanic) 1	31 (9·3%)	17 (5·4%)	48
	333	313	646

One great advantage of this method is that in a comparison of the population numbers over a succession of years, no allowance need be made for the different types of weather prevailing on each occasion. In this case we are dealing with the population on purely a percentage basis. Thus, whatever the numbers of individuals in the colony, only a certain proportion will be on the wing each night. Of these a few will be caught, classified, marked, and set free again, the total number thus being unaffected. In this way, cumulative information is obtained each night concerning a small proportion of the total population. By appropriate statistical analysis of the numbers captured, and the frequency with which individuals are recaught, a good idea can be obtained of the size of the colony itself. It is thus apparent that the actual numbers of specimens caught in successive years will be of no importance whatever, always provided that these are large enough to be of statistical value.

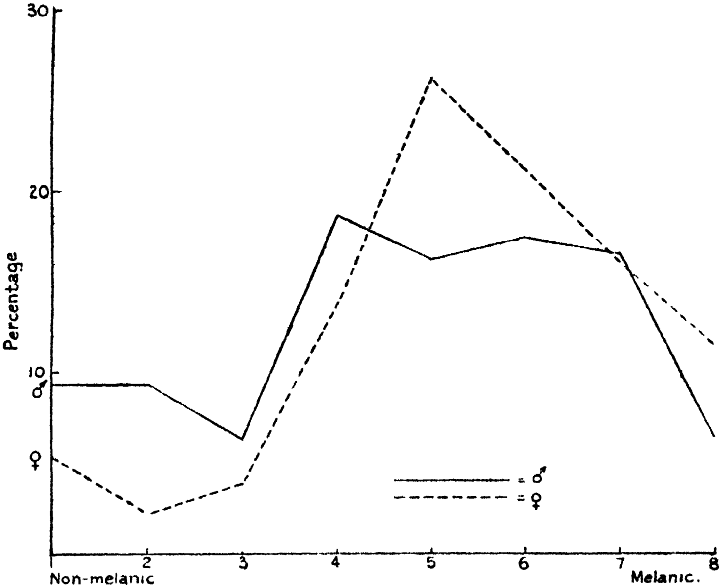
Our data have been analysed by Prof. R. A. Fisher, who comes to the following conclusions: With a system of marking and releasing such as the one employed, one would normally expect a continuous increase in the number of individuals recaptured throughout the succession of observations. Actually no such significant increase was found, which can only be accounted for by assuming a very high elimination rate, either by death or by migration from the colony. Having regard to the extreme localization of the insects indicated, as already mentioned, by our sugaring results, the latter alternative may reasonably be dismissed.

Judging by a graph of days plotted against the calculated numbers flying on each occasion, it would seem that 70% is definitely too high a survival rate; for this would lead to a considerable increase in numbers during the last two days, which, in fact, did not occur. Actually, an elimination of 50% per day fits the data, and leads to an estimate of 4500 for the total population. The number of insects flying would be about 1000 at their highest level. Since on this occasion no system of dating our releases was adopted, it is impossible to put forward any concrete suggestion to account for such a high death-rate in the population, also for the apparent probability that the survival-rate is higher at the beginning of the season than it is at the end. On future occasions we intend to employ some system of dating the individuals captured and released, and in this way it may be possible to find some solution for this rather extraordinary state of affairs.

The question of melanism is one of particular interest, owing to its enormous spread during recent years in a number of different species. Further, in a large number of cases these melanic forms have come to be associated with industrial areas. This, however, cannot be so on the west coast of Scotland, for not only are there no manufacturing towns near, but also it appears that melanism becomes more intense as the range extends northwards. Thus on comparing specimens of *Xylophasia monoglypha* caught in the Outer Hebrides last year with those from Cara, it was at once obvious that the former showed on the whole a very distinct tendency towards increased melanism.

In order to get some idea of the relative proportions of melanics, a colour scheme was adopted, as has already been mentioned. We selected eight specimens showing, as accurately as we could judge, a gradation from non-melanic to the most extreme condition of melanism, and these were used in classifying all the *monoglypha* captured. Of course, with this method of selecting a colour scheme, it was quite impossible to judge by eye the exact gradation between each degree of melanism. However, as will be seen from the accompanying diagram, it gives some idea of the relative amount

of melanism occurring in males and females. Eggs were obtained from two extreme melanic and two non-melanic females. Three broods hatched between August 8th and 10th, those from one light female being infertile. Despite a very high mortality in the young larvae, enough now remain for us to carry out breeding experiments, provided that the greater number of these pupate and emerge successfully. Thus we hope, in the course of the next few years, to be able to find out the genetics of melanism in *Xylophasia monoglypha.*



As a result of previous work on the subject, we see that melanism may behave in a number of different ways. Thus it may be due to a simple dominant, as in *Hemerophila abruptaria* (Onslow, 1921), where the melanic var. *fuscata* appears to be hardier than the normal form, a much larger proportion of melanics than typical individuals being able to withstand cold weather as a second brood under experimental conditions. Again, the melanic form may be a recessive, as in *Selenia bilunaria* (Harrison, 1928), or it may show an intermediate condition in the heterozygote, as in *Aplecta nebulosa* (Bowater, 1914). In the latter, the melanic form var. *thompsoni* is homozygous, var. *robsoni* being the heterozygote. In *Spilosoma lubricipeda* the melanic form is due to a single factor-pair with other multiple factors affecting its expression (Federley, 1920). In this case the heterozygote is intermediate, but nearer the melanic var.

zatima. Multiple factors may control melanism in some forms, such as *Lymantria monacha* (Goldschmidt, 1921), in which one sex-linked and two autosomal dominants are concerned. Rather a similar condition is found in *Oporinia dilutata* (Harrison, 1920), but in this case melanin deposition is governed by many more factors. Thus in the F_2 generation a complete series occurs, ranging from melanic through intermediate to non-melanic. Finally we have melanin production determined by multiple allelomorphs, as in *Aglaia tau* (Standfuss, 1910), in which vars. *meliana* and *ferenigra* are each dominant to the normal form, and the homozygotes are darker than the heterozygotes. The combined action of the multiple allelomorphs is to produce var. *weismanni*. In the case of *Xylophasia monoglypha*, owing to its extreme variability, it seems likely that melanism must be controlled by multiple factors in a somewhat similar manner to *Oporinia dilutata*.

Thus, from a series of observations such as those described, it is hoped that it may be possible to determine -

(1) The genetics of melanism in *Xylophasia monoglypha*.

(2) Whether or not marked fluctuations in numbers occur in the population.

(3) If such fluctuations do occur, how is the percentage of melanics affected?

In conclusion I should like to thank Prof. R. A. Fisher, F.R.S., for analysing our data, also Mr. E. B. Ford for his kind advice and many helpful suggestions.

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20

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Notes on larvae and pupae of Polygonia c-album Linn. (Lep.).

The following notes embody observations by Lt.-Col. H. D. Peile communicated to me.

A number of larvae were found on hop on 31st August, 1935: they were nearly all at rest during the day and fed mostly at night. It was particularly noticed that they all assumed at rest a spiral attitude, the angle where the larva was raised to one side away from its support being about where the white posterior portion joins the brown anterior part, and the fore part and the head being curved round to the opposite side so that the line of continuation of the larva appeared as if broken up. The pupa also showed breaking up of the ground colour by patches of purplish-black and brown at angles to one another on both sides, aided by spots of gold and the various projections. None of the twenty-five larvae yielded parasites.

The chief point of interest in these notes appears to me to be that this larva is procryptic and feeds at night. The black and pale-spotted larvae of *Aglais urticae* Linn. and *Nymphalis io* Linn. have the habit, common in conspicuous larvae, of feeding in companies and do not restrain their movements until after dark.

G. D. Hale Carpenter.

21

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THE COMMA BUTTERFLY, *POLYGONIA C-ALBUM* (LINN.): ITS DECADENCE AND REVIVAL AS A BRITISH INSECT.

By JAMES J. WALKER, M.A., R.N., F.L.S.

This very interesting and beautiful butterfly, which for many years had appeared to be within measurable distance of practical extinction as a British species, has so widely extended its range and increased in abundance in our midland and southern counties during the last two decades, as, in some localities at least, to challenge comparison in numbers with the more ordinary species of Vanessid butterflies. A useful purpose may, therefore, be served by presenting a summary of its occurrences during the long period of its eclipse over the greater part of its range in old times—omitting the records from Wales and the western English counties, where the insect held its own most successfully during those critical years—and to give a brief account of its progressive increase in numbers and extension of range from the year 1921 onwards.

Polygonia c-album was first somewhat inadequately described and figured as a British butterfly in 1634 by Thomas Mouffet in his 'Insectorum sive Minimorum Animalium Theatrum,' p. 104, No. 7. All the writers on our native insects during the eighteenth century appear to have regarded it as a somewhat rare species, but widely distributed throughout England, extending to our northern counties, but not passing the Scottish Border or occurring in Ireland. Haworth (1803) writes as follows :—' HABITAT *Larva* in Humulo Lupulo m. Jan. [!] m. Aug. *Imago* i Jul. i Sept. in Sylvaticus satis infrequens.' There would appear to have been a temporary revival of the species shortly after that date, as C. W. Dale (1890) records it as having been 'very common in Dorset in 1807, but after 1816 none were seen until 1877, when a specimen was taken

near Dorchester.' In the Dale Collection, now in the Oxford University Museum, there is an example in excellent preservation dated 1816, taken by J. C. Dale at Glanvilles Wootton, Dorset. By J. F. Stephens (1828) it is stated, 'This species [*Vanessa c-album*] has become somewhat scarce everywhere within these few years. Prior to 1813 I used to find it very abundantly near Hertford, but since that period I have not seen it — it has, however, occurred during the last and present seasons in several parts of the country, and it appears to be generally distributed over the southern half of the kingdom, frequenting woods, thickets, and gardens. There are two broods in the year.' In a footnote he adds, 'Mr. Backhouse informs me that it is abundant near York.' And Henry Doubleday, as quoted by Newman in his 'British Butterflies,' writes, 'Many years since it used to occur in profusion at Epping [Essex]. I cannot give any date, but . . . I should judge about 1817 or 1818.'

The retreat of the butterfly from the metropolitan and southern counties of England thus appears to have commenced well before the middle of last century, and by 1857 had so far progressed that in this year we find H. T. Stainton writing as follows:—'This has disappeared from many places where it was formerly abundant. All the old writers record it as being "abundant near London," and many entomologists now living can remember that, when they were young, such was the case.' It may be noted that the most eastern locality given at that time for *Grapta c-album* by Stainton was Peterborough (Northants). Edward Newman (1871) also writes, 'A noticeable feature of its distribution is its absence from what may be called maritime lists, as those from Norfolk, Suffolk, Kent, Sussex, Isle of Wight, Dorsetshire, Devonshire, and Cornwall: this absence from the lists is not sufficient evidence of the butterfly's not occurring there, but certainly of its great rarity, or it could not have escaped the notice of entomologists.'

The following table of the occurrences of *Polygonia c-album* —in the great majority of instances as single specimens—in the eastern, midland, and southern counties of England, has been compiled from the entomological journals and records between 1806 and 1921, the year of its pronounced revival; and it will serve to illustrate the casual nature as well as the rarity of its appearances in these counties during that period of its eclipse for upwards of sixty years.

Counties.	No. of Records.	Counties.	No. of Records.
Lincoln - - -	1	Kent - - - -	11
Nottingham - -	3	Sussex - - -	7
Derbyshire - - -	1	Surrey - - -	3
Staffordshire - -	3	Hampshire (and Isle of Wight) - - -	4
Warwickshire - -	2	Berkshire - - -	2
Northampton - -	1	Wiltshire - - -	1
Cambridge - - -	2	Dorset - - -	2
Suffolk - - -	2	Somerset - - -	2
Essex - - - -	4	Devonshire - - -	2
Middlesex - - -	1		
Buckingham - -	1		
Oxfordshire - -	6	Total - - -	61

No records of the butterfly appear to have been received during these years from the counties of Leicester, Bedford, Norfolk, Hertford and Cornwall. From this table it will be seen that the hop-growing counties of Kent and Sussex have been most favoured by the butterfly during this long period of scarcity. This may be a survival in some measure of its ancient abundance in these parts, on which Newman (l.c.) thus writes in 1871:—'From many sources I learn that this butterfly was said to be common in the Maidstone hop district half a century ago.' The possibility of migration from the Continent to these adjacent shores must not be overlooked, though the insect, unlike others of its family, exhibits no very strong propensity in that direction; but a quite recent instance of its migration on a small scale in Surrey has just been recorded (1938) by Mr. A. W. Buckstone. The date and locality of one or two of the records in the preceding Table are of sufficient interest to be worthy of special notice. Thus, as regards Suffolk, I am much indebted to Sir E. B. Poulton, F.R.S., for the following highly interesting account by his friend, Mr. H. M. Wallis, M.B.O.U., of a specimen of *P. c-album* observed by him as long ago as 1871 at Woolverston Park on the river Orwell. Mr. Wallis writes, 'I was lying . . . under a tall oak . . . looking at the sky. It was August, I think. I saw a leaf detach itself and begin to fall exactly above me, forty feet away. It came spinning down, and when a few inches from my face, opened a pair of brown wings, turned to the trunk and settled there with wings closed again—a *Comma Butterfly*, with the white C on its under surfaces. It was the first I had ever seen anywhere, though I had collected for about five or six years. I have never heard of any locality in Suffolk for this

curiously variable insect.' And I remember well the interest excited among the entomologists then present at that famous old Kentish locality, Chattenden Roughs, by the capture in July, 1877, of a fine example of the butterfly by a young friend of my own.

During this long period of its eclipse over the greater part of England, *Polygonia c-album* held its own, though not without occasional years of scarcity, in Wales and in the adjacent border counties. Thus W. S. Coleman (1860) 'found it very plentiful on the banks of the Wye, in 1858.' Its principal stronghold, however, was in the hop-growing districts of Worcestershire and Herefordshire. In the latter county it had been reported by Newman (1864) as having occurred in former years in great abundance at Leominster; and that well-known and highly esteemed lady entomologist, Mrs. E. S. Hutchinson, during her long residence at Grantsfield near that town, acquired an altogether unrivalled experience of *Polygonia c-album* in all its stages; while the unstinted generosity with which she supplied our collections with this much-desired butterfly is gratefully remembered by many of our older Lepidopterists even at the present day. In favourable seasons the handsome and conspicuous caterpillars—locally known as 'Hop-cats,' while the pupae were called 'Silver-grubs,' and the equally abundant and conspicuous larvae of the Pale Tussock Moth, *Dasychira pudibunda* (Linn.), as in Kent, rejoiced in the name of 'Hop-dogs'—were to be found in numbers in the Leominster hop-gardens at the time of the hop-picking; but as Mrs. Hutchinson writes (1881), 'There is a habit here in hop-grounds of collecting all the bine after the gathering is over and burning it, and thus all the larvae and pupae which have not been destroyed, when the poles are torn down and the hops gathered, perish in the fire, excepting those which have emerged and thus escape destruction,' a practice which must tend to reduce greatly the numbers of the butterfly in most seasons. Further, Mrs. Hutchinson writes (l.c.), 'I . . . have lived in this county and noted the habits of *P. c-album* for fifty years; and I can safely say I never remember the species so common in any autumn as the present one, except in the year 1875, when every blackberry bush was covered with specimens of this lovely and distinct species until late in the autumn. . . . This year I have had about one thousand larvae and pupae brought me from the few hop-grounds in our parish; and I learn that around Tenbury, where hop-grounds are far more plentiful than here, the species swarms, and it has been sad to see the destruction of larvae and pupae.' Some years afterwards Mrs. Hutchinson gave me an amusing account of the result of her generous but somewhat rash offer (l.c., p. 252) to distribute the butterfly gratis to entomologists. Much

embarrassment and not a little annoyance were caused to the local postal service by the overwhelming number of boxes of all sorts and sizes forwarded for that purpose; if I remember rightly, the number of requests for the butterfly was estimated by her as nearly 900, and some of the less scrupulous applicants were not to be satisfied with fewer than twenty or thirty specimens.

It may be noted that these years of plenty were succeeded by seasons of great scarcity; thus (l.c., p. 252) 'the wonderful abundance of 1875 was followed by a nearly total absence of the species in 1876 and 1877, during which years I did not at any season obtain a single egg, larva or pupa, and one imago only'; and this also appears to have been the case in Herefordshire for several years after 1881.

This long period of decadence came almost abruptly to an end in the fine hot summer of 1921, and nowhere was this recovery so marked as in the immediate neighbourhood of Oxford. The number of specimens captured or observed here in the sixteen years from 1904 onwards might almost have been counted on the fingers of one hand; and the first *Polygonia c-album* that I had ever seen at large was taken by me at Cothill, Berks, on 29th July, 1918. A few specimens that were seen in the early summer of 1921 were the harbingers of the copious brood which unexpectedly appeared in the first half of September. In its favourite localities it was then actually more numerous than *Aglais urticae*, and in a damp meadow adjoining Tubney Wood, Berks, 'the insect suddenly became sufficiently plentiful to admit of three or four being seen at one time, sunning themselves with expanded wings on the purple flowers of the Devil's-bit Scabious, in which situation few if any of our butterflies present a more effective appearance. Stray examples, too, were not infrequently seen at the Michaelmas daisies and other flowers in the Oxford gardens, as well as on the abundant crop of ripe blackberries at Wytham Park [Berks] and elsewhere.' In subsequent years this meadow could always be relied on to supply the butterfly in greater or less numbers at the proper season, and on one occasion, 3rd October, 1930, I counted here in less than an hour no fewer than forty newly-emerged specimens on the Scabious flowers. There can be no doubt that *Polygonia c-album* is now fully established in the Oxford district, as in no year since 1921 has it failed to visit my small garden in North Oxford, or the Asters and Sedums in the University Parks, as well as the purple racemes of the *Buddleia variabilis*, which is now so well known as a prime favourite of the Vanessidae and other butterflies since attention was drawn to its attractions by the present writer in 1914. A friend informs me that the late summer brood appeared in numbers last year at one of the favourite haunts of the insect

in the extensive woodlands a few miles east of the City of Oxford.

In 1921 *Polygonia c-album* was also recorded from such widely separated stations as Birmingham, Southbourne, Hants, and Holcombe, Devon; and after its marked revival in that year, the notices of its occurrence in new and hitherto unexpected localities in the pages of the entomological magazines, and in particular those of the *Entomologist,* become too numerous to be more than very concisely summarized. In Warwickshire, where in 1922 it was observed in plenty after hibernation at Coventry, Mr. Bolton-King (1923) states that it 'seems to have maintained its last year's numbers . . . when it was more plentiful than in any previous season.' In this year, also, it was noticed sparingly in Somersetshire. The first records that can be traced for Bedfordshire were from Bedford on 3rd September, 1923, and another there in the same month in the following year; while the records in 1925 from Purfleet, Essex, and Brampton, Huntingdon, already point to a wide extension of its range.

In this year the butterfly was also reported from Ewhurst, Kent, while in 1926 and 1927, a remarkable increase in its abundance, comparable with the outburst observed five years previously in the Oxford district, was noted in Hampshire and the adjacent counties of Dorsetshire and West Sussex. Thus the autumnal brood was fairly common in the New Forest in September, 1926; it was recorded as occurring in plenty on the Hants and Dorset border in the succeeding autumn, and later on as being 'well established' in these counties and in Wiltshire. In 1928, besides being met with as near London as Twickenham and Chiddingfold, Surrey, it had reached the south coast at Portsmouth and Keyhaven, Hants; and almost for the first time, several records were received from the Isle of Wight, where in 1929 'quite a number' were observed. In this year, besides being noted at such almost suburban localities as Walton, Elstead, Henley and Cookham, Surrey, the butterfly commenced definitely to spread to the south-western counties, as a good many records were received from Somerset, and on 19th July it was observed in some numbers at Sidmouth, South Devon. In 1930, besides occurring as near London as Surbiton and at Gravesend, North Kent, also at Chichester in some abundance, the first known record from the county was made at Wicken, Cambridge, on 18th August. H. D. Kettlewell (1931) writes, 'On April 29th and 30th I was in the New Forest. *P. c-album* was exceedingly common along nearly every ride, nearly 90% being male specimens.' It would seem, however, to have been much scarcer in the Forest at about the same time in the following year, but was reported as being plentiful at Arundel, Sussex, on 3rd August, 1931, and from

Honiton and Starcross, Devon, in August and October; it appears to have been established at Honiton since the year 1926. A specimen taken at Brockley, south-east London, as long previously as 4th August, 1917, was recorded in 1932, as well as its occurrence at Pitch Hill and Chiddingfold, Surrey, in every year since 1929. In 1933 a capture was reported on 3rd August at Cheadle, Cheshire, a county from whence there are but few records of the butterfly, and from Walthamstow, close to London, on 5th October. In this year it was widely distributed in Surrey, about sixty specimens having been seen by a single observer (1934) during June and July, though the autumn brood was not as plentiful; and on 11th September thirty or forty were seen at Ivybridge, Devon. But the most interesting record for the year is certainly that of Mr. F. W. Frohawk (1934), stating that 'three larvae were found by Mr. C. H. Goodwin, feeding on hop in his garden, at Norbury,' South London, all of which duly pupated and emerged.

In 1934, besides records of *Polygonia c-album* from Leicester, Luton, Beds., Grantham, Lincolnshire, and Wretham, Norfolk—all notable localities as showing the continuous extension of its range—we have the first notice of its appearance in Cornwall (1935) as being abundant in the valley of the West Looe River in the second week in July. In this county the butterfly would appear to have speedily found a congenial home, as in the same year it was reported from some half-dozen additional Cornish localities, and in 1935 it was the most numerous Vanessid at Truro. Several records for London itself are given by Mr. N. D. Riley (1935) in a very interesting summary of its occurrences in the preceding year; he cites Mr. H. J. Burkill as reporting that an old gentleman—who was evidently aware of the interest of the butterfly's appearance in the heart of the City—was observed chasing one in Old Broad Street and trying to catch it with his hat!

C. H. Hutchinson (1936) states that in the previous year, 'During October and until the end of the month there were thousands of them on the wing both in the woods round Polegate [Sussex] and in the valleys of the Downs,' and in the same month it was again plentiful in the New Forest. A second record from the county by Dr. A. D. Imms, F.R.S., at Cambridge, is also noteworthy, and it also occurred quite commonly at Rushden, Northamptonshire. A record by Miss K. M. Hinchcliff, of two specimens of *Polygonia c-album* seen in her garden at Instow, North Devon, on 4th October, 1936, is interesting from the fact that the last capture of the insect there was made as long ago as 1864 by the well-known entomologist, the late Mr. G. F. Mathew, R.N. Other records for 1936 cited by Mr. N. D. Riley (1937) include King's Lynn (Norfolk), Witham and Chelmsford (Essex) and Gravesend (Kent) where

it 'continues to occur'; and a personal observation as follows: 'In London itself the only *c-album* that came to my notice was in Queen's Gate Gardens, S. Kensington, where I was invited by the Hon. Catherine Thring . . . to confirm her identification; the insect kindly waited for me.' The most important memoir on the butterfly that appeared during this year is, however, the excellent annotated list by Mr. S. B. Hodgson (1936) of the records in recent years of *Polygonia c-album* in the county of Hertford. Since the days of J. F. Stephens in the thirties of last century, Mr. Hodgson states that 'there seems to be no other available information of its occurrence in our county prior to 1919 when our modern records commence. It is extremely unlikely that the butterfly suddenly completely disappeared in 1833, but we may safely assume that it was practically entirely absent over a period of about 80 years.' The detailed list of occurrences of the butterfly in Hertfordshire from 1919 to 1935 inclusive (*l.c.*, pp. 44-5) records about sixty independent observations of the species in the county or just outside it, and a minimum total of seventy-five butterflies seen over a period of fifteen years. The list is no doubt incomplete, but seems to indicate that progress has been intermittent rather than continuous, and has accelerated during the last few years.

In 1937 the records of *Polygonia c-album* showed a distinct falling off from those of previous years, doubtless owing in part to the fact that, as stated by Mr. N. D. Riley (1938), 'It seems to be fairly well established now in most of the new territory it has invaded in the southern counties, but was not by any means so common in many of its new localities as it had been. A further eastward extension of its range is evidenced by records from Ipswich . . . and from Dovercourt.' Finally, the butterfly has at long last reached my old happy hunting-ground in the Isle of Sheppey, as a correspondent at Sheerness informs me that he saw two specimens at Minster in 1936, and another in the following year.

In speculating on the cause of the return of *Polygonia c-album*, within the few last years, to its traditional resorts of upwards of a century ago, and its apparently successful re-occupation of so many of these, we are faced with a problem of no small difficulty. In a very interesting note in *Nature*, Mr. N. D. Riley (1929) suggests that 'the above records . . . appear to indicate fairly definitely a radial dispersal of the very attractive butterfly under discussion that commenced sometime between 1910 and 1915, and had the Wye Valley as its centre. Dispersal was primarily in a northern and north-eastern direction, afterwards mainly eastern and southern, the isolated records from Essex (1919) and Eastbourne (1924 and 1926), as already suggested, not forming part of the main

phenomenon.' 'The Kentish [1916] and Eastbourne [1918] records are interesting as, taken . . . with others given below, they seem to suggest that the butterfly had in fact been maintaining itself somewhere in the south-east corner of England in spite of its apparent absence . . . It may, of course, be argued that the facts recorded . . . are as readily to be explained by a sudden general increase of population among very small and hitherto overlooked colonies scattered through the area under consideration, as upon the hypothesis of a migration from the Wye Valley area, but the evidence in my opinion favours the latter view. In any case, however, no suggestions have been made that would account for it.'

As regards the sudden appearance of the butterfly in such numbers near Oxford in the late summer of 1921, I am personally inclined to the opinion that this increase arose from a series of local conditions more than usually favourable for the life of the insect in its earlier stages, as it had been observed in the district, though very rarely and at long intervals, for many years previous to that date.

Has the Comma Butterfly 'come to stay' in its recently re-occupied territory, which comprises so large an area in the southern and eastern counties of England? This is, of course, a question which time alone can answer; but when we consider its present abundance in so many of its new haunts, and its extensive range of common food-plants—hop, nettle, elm, and currant, to mention only its chief favourites—we may reasonably expect that the insect will hold its own for at least a good many years to come. It is true that the species among our native butterflies most nearly related to *Polygonia c-album*, the Large Tortoiseshell, *Nymphalis polychloros* (Linn.), is evidently at the present time passing through a somewhat similar eclipse, as for several years past it has become much scarcer than was previously the case, and has even vanished altogether from many places where it used to be found in plenty. On the other hand, we have quite recently seen a pronounced revival in the case of the White Admiral, *Limenitis camilla* (Linn.), which about the year 1860 disappeared suddenly and completely from a large number of its well-known localities in the south of England, but has lately occupied many of these in even greater abundance than was formerly the case.

It is a matter of common knowledge that our non-migratory Vanessid butterflies—even the Small Tortoiseshell, *Aglais urticae* (Linn.), the most widely distributed and abundant of all—are subject to great fluctuation from year to year in their numbers; and it may happen that *Polygonia c-album* will in its turn again be reduced almost to vanishing point in many places where it is more or less plentiful at the present time. But we

may reasonably hope and expect that in those parts of our country which it has so recently occupied, this welcome visitor to our gardens will continue to display its most distinctive form and colours on our late summer flowers for many seasons to come.

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Agdistis staticis Millière (Lep., Pterophoridae) taken in Cornwall by Dr. C. H. Andrewes, M.D., F.R.E.S.

On 21st August, 1937, I captured a pair of plume moths *in coitu* at Aire Point, about two miles north-east of Land's End, Cornwall. They were sitting on dry grass near a patch of *Statice binervosa* (G. E. Smith) on the cliff. This patch was

less than a hundred yards long and was the only *Statice* I saw on my month's holiday in that neighbourhood. Thinking that the plumes might be something unusual, I visited the spot on two other occasions and on 30th August I took another specimen on the *Statice* patch. The wings of the plume-moths were held forward almost in line with the body. This made them more difficult to see on dry grass than is the case with other plumes.

The insects have kindly been identified by Mr. Tams of the Natural History Museum as *Agdistis staticis* Mill.

[This plume-moth was first recorded from Portland, described by Tutt as *A. benneti* Curt., var. *portlandica*, but recognised as a distinct species by Meyrick, who described it as *clivicola*.[1] K. G. Blair[2] in 1929 found larvae (on *Statice binervosa* near Saunton, N. Devon), which resembled those of *A. staticis*, preserved in the National Collection. Similar larvae were found on the same plant in the following year on the cliffs near Seaton, S. Devon, near Braunton, and near Bolt Head and Hope Cove, S. Devon. Moths were bred and determined by W. H. T. Tams[3] as *A. staticis*, specimens of which from Southern France, Sicily, Dalmatia, Algeria and Tenerife exist in the B.M. Collection. *A. clivicola* from Portland is also determined by Tams to be identical with *staticis*, a conclusion with which Meyrick is in complete agreement. Dr. Andrewes is to be congratulated on his evidence of an extended range for this interesting moth.

In writing this little note I wish to thank my friends Mr. Meyrick and Mr. Tams for their kind help and Mr. Blair for his paper.

EDWARD B. POULTON. *12th Nov.*, 1937.]

1 1927, Revised Handbook of Brit. Lepidopt.: 461.
2 1931, *Ent. Mon. Mag.*, **67**: 84-7, Pl. III.
3 1931, *Ibid.*, **67**: 87-8.

[*Reprinted from The Proceedings and Report for 1935 of the Ashmolean Natural History Society of Oxfordshire.*]

Interim Report on Coleoptera and Lepidoptera.

Once more we have to record a decidedly poor season for insects in general. A cold and tardy early spring was followed in mid-May by a frost of almost unprecedented severity for the time of year, and one of its results was evident in the abnormal scarcity of the usually abundant Geometrid moths of late autumn. June, too, proved almost equally ungenial, and the long spell after midsummer of bright, warm, but very dry weather was again unfavourable to beetle life in general. But in spite of these drawbacks, and the fact that such collecting as I am now able to undertake was confined to the immediate neighbourhood of my house, some interesting insects were obtained, and several additions were made to our extensive local list of Coleoptera. Most noteworthy is *Philonthus rectangulus* Sharp, a conspicuous species which was described as long ago as 1874 from Japan, and in recent years has extended its range through North America to Europe and our own islands. It was introduced to the British list by the Rev. C. E. Tottenham so recently as last August (*Entom. Mon. Mag.* LXXI, p. 174). My first specimen was taken on September 1st, 1934, in a dry manure-heap at Summerfields Farm, where it was again found not rarely last year from July 1st onwards, in stable manure and decaying cut-grass. It also occurred somewhat freely to Messrs. Donisthorpe, Tottenham and Blair early in July in a small manure-heap close to the entrance of Bagley Wood at 'Little London.' Mr. J. Collins has also taken the beetle last spring in a decayed fungus, and it has been found in several localities as far north as Whitby during the past year. Other additions to our local list are *Atheta picipennis* Mann., taken by Mr. H. Britten near Headington so long ago as 1917; *Anthicus bifasciatus* Rossi, a very pretty little species first met with by Mr. J. Collins under elm bark near Water Eaton, and later by myself in plenty in manure-heaps at Summerfields Farm, with numerous specimens of the neat little Histerid *Carcinops 14-striata* Steph., previously taken singly in my house in 1905. In the same locality *Ceuthorrhynchus parvulus* Bris., a distinct little species hitherto recorded only from Devon, was taken sparingly in June 1934 on a stray patch of *Nasturtium palustre* Dc. in a dry place; and *Cryphalus tiliae* Panz. was swept up singly on July 9th by the side of the new by-pass road near Summertown. To these may be added the curious little Clavicorn beetle of world-wide distribution, *Lophocateres*

pusillus Klug, which was found—boiled, but an excellent specimen notwithstanding—in 'butter-beans' which were said to have come from Madagascar.

So far as my own observations go, the season for butterflies was again much below the average. No 'Clouded Yellows,' *Colias croceus,* were reported, and, as was the case in 1934, scarcely half-a-dozen specimens of the 'Large White' *Pieris brassicae* were seen during all the summer, and not a single 'Small Copper,' *Lycaena phlaeas,* came under my notice. The butterfly of the year was undoubtedly the 'Red Admiral,' *Vanessa atalanta,* which was abundant everywhere in August and afterwards, though no early immigrants of this species were seen by me. The 'Comma,' *Polygonia c-album,* occasionally visited my garden, and was reported as plentiful in the woods beyond Stanton St. John, where a fine example of the entirely black variety (ab. *nigrina*) of *Limenitis camilla* was taken in July by Mr. Walter Burrows. The 'White Admiral' also strayed as far from its headquarters as my garden in Summertown, where a specimen was seen on August 4th visiting the blossoms of that attractive shrub *Buddleia variabilis.*

J. J. WALKER.

[*Reprinted from the 'Ashmolean Natural History Society of Oxfordshire Proceedings and Report for 1936.'*]

Interim Report on Coleoptera and Lepidoptera.

Once more there is a decidedly unfavourable season—practically another 'lost summer'—to record for the past year. Gloom, persistent rain and belated frosts have all tended to reduce the number of insects, both as species and individuals; moreover, as far as the present writer is concerned, all his outdoor work has perforce been restricted to the Summerfields meadows and allotments, and the adjacent right bank of the Cherwell. Even in this limited area, however, a good many interesting beetles have been taken, and at least three important additions have been made to our local list of Coleoptera during the year. The rare *Bruchidius rufipes* Hübn. was taken near Yarnton on *Vicia sepium* in some numbers by Mr. J. Collins, and on two occasions by myself at Summerfields, where also on August 3rd the first recorded British example of the black form of *Lissodema cursor* Gyll., itself one of the rarest of our native beetles, appeared in my sweeping-net to my great surprise and satisfaction. To these may be added the very interesting Clavicorn beetle *Aulonium trisulcum* Geoff., parasitic on the destructive bark-beetle *Eccoptogaster scolytus* Fab. This has been bred by Mr. D. E. Parker from elm bark collected at Wolvercote and Studley, and with it the rare *Nemosoma elongatum* L., which has not occurred in the district since it was found by Mr. Collins in 1913.

With a few exceptions, Lepidoptera have again been much scarcer than in the more genial summers of the past. Such ordinary butterflies as the Small Copper (*Lycaena phlaeas* L.) and the Common Blue (*Polyommatus icarus* Rott.) were indeed hardly seen by me at all throughout the season, and the Large White (*Pieris brassicae* L.) again appeared in far less than its usual numbers. A few Clouded Yellow (*Colias croceus* Fourc.) were observed in late summer in various places in the neighbourhood of Oxford, one being seen by myself close to my house. Fresh specimens of the Painted Lady (*Pyrameis cardui* L.) and the Comma (*Polygonia c-album* L.) were frequently noticed in the City gardens, the latter being fairly plentiful further afield; but the butterfly of the year was beyond question the Small Tortoiseshell (*Aglais urticae* L.). The autumnal brood emerged in num-

bers far in excess of that of recent years, the Michaelmas daisies and other late flowers being at times literally crowded with this pretty butterfly, of which a specimen of the rare variety *ichnusoides* De Selys was taken by Mr. W. Burrows at Hell Coppice on September 17th.

An extensive migration to our southern counties of the Silver-Y Moth (*Plusia gamma* L.) occurred in June last, and this insect was much in evidence in the Oxford meadows about midsummer.

J. J. WALKER.

February, 1937.

B

Report on Trichoptera and Plecoptera.

There is an unexpected number of additions to be made to the local list as the result of collecting by myself and my son (A.D.G.) in 1936. *B. pullata* Curt. is a welcome capture by Dr. B. M. Hobby, confirming the place of the species in the list, as this rested hitherto on two females from Hogley Bog. It is satisfactory to begin to get further records of Hydroptilids, of which there must be more to follow.

Limnophilus marmoratus. Blenheim Lake, 8.xi (A.D.G.).

Setodes tineiformis Curt. Blenheim Lake, 15.ix (L.W.G.).

Beraea pullata Curt. Cothill, Berks, 25.v (B. M. Hobby).

Agraylea multipunctata Curt. Blenheim Lake, 12 & 15.ix (A.D.G.).

Hydroptila sparsa Curt. R. Thames at Osney Bridge, 17.ix (L.W.G.); Blenheim Lake, 12.ix (A.D.G.).

H. maclachlani Klap. R. Thames at Osney Bridge, 17.ix (L.W.G.).

Orthotrichia tetensii Kolbe. Blenheim Lake, 15.ix (L.W.G.).

It may be useful to mention here the following records for other parts of Oxfordshire, adding eight species in all to the county list :

Tinodes unicolor Pict. Deddington, 20.vii (L.W.G.).

Hydroptila sparsa Curt. Thame, 30.v (A.D.G.); Deddington, 1.vi (L.W.G.).

Ithytrichia lamellaris Eaton. Burford, 15.vi (A.D.G.).

We have also to note an additional stone-fly:

Amphinemura standfussi Ris. Deddington, 1.vi (L.W.G.).

L. W. GRENSTED.

C Trichoptera in 1936.

The following county records are based upon specimens brought in to the Hope Department, Oxford, by Professor G. D. H. Carpenter (C), Dr. B. M. Hobby (H), and Mr. E. W. Aubrook (A), from Cothill, Wytham, Bagley Wood, and Kennington (Berkshire), Burton Bradstock (Dorset), Chedworth (Gloucestershire), and Trewey Road, near Zennor (Cornwall). I have not included Oxfordshire species already recorded elsewhere.

Phryganea varia F. Trewey Pond (C), 11.viii.
Grammotaulius atomarius F. Kennington (H), 1.ix.
Glyphotaelius pellucidus Retz. Wytham (H), 3.vii.
Limnophilus rhombicus L. Kennington (H), 25.ix.
L. flavicornis F. Kennington (H), 13.viii.
L. lunatus Curt. Kennington (H), 25.ix.
L. vittatus F. Trewey Pond (C), 11.viii.
L. affinis Curt. Burton Bradstock (H), 17.ix.
L. auricula Curt. Wytham (A), 16.v.; Bagley Wood (H), 26.v.1935.
L. sparsus Curt. Kennington (H), 25.v.1935.
Leptocerus albifrons L. Chedworth (H), 5.vii.
Beraea pullata Curt. Cothill (H), 25.v.

L. W. Grensted.

ON THE COLEOPTERA, ETC., OF THE FAROE ISLANDS.

BY JAMES J. WALKER, M.A., R.N., F.L.S.

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The first part of Volume II of 'The Zoology of the Faroes: edited by Ad. S. Jensen and others' (Andr. Fred. Høst and Søn, Copenhagen: 1928-1937) deals with the Crustacea, Myriopoda and part of the Insecta. The scanty terrestrial fauna of these remote subarctic islands, situated in the most stormy region of the North Atlantic Ocean, presents certain features of considerable interest from the point of view of animal ecology and of geographical distribution; and the detailed accounts of the various groups included in this part, which are presented throughout in excellent English by a highly competent body of specialists, form a valuable contribution to our Zoological knowledge.

The Faroe Islands are intersected by the 62nd parallel of north latitude, and together occupy an area of 511 square miles, being

distant from the nearest land (Unst, Shetland) nearly 200 miles, and rather more than 280 miles from the south coast of Iceland. All the islands are mountainous and attain a considerable elevation, culminating in Slatteratindür (Osteroë), 2,984 feet above sea-level. A certain amount of cultivation is practicable in sheltered situations at low levels, but most of the surface of the islands consists of bleak moorland and pasture, while trees, with the exception of a few of the hardiest kinds carefully protected from the too prevalent gales, are entirely absent. The growth of certain forms of herbaceous vegetation is, however, surprisingly luxuriant in many favourable situations. When their high northern latitude is considered, the climate of the Faroes is mild and equable, severe frosts in winter being almost unknown, but as a rule the weather is humid and boisterous, with frequent fogs and a marked deficiency of sunshine.

Under these conditions of isolation, climate and vegetation, an extensive insect fauna is not to be looked for. Fourteen Orders in all of insects are represented in the Faroes; of these three, the Hymenoptera, Hemiptera and Diptera, remain to be dealt with in a forthcoming part of the 'Zoology.' The 250 species of insects recorded in Part I are distributed among the eleven Orders as follows:—

		Species.
THYSANOPTERA.	(*Kai L. Henriksen*) - -	1
COLLEMBOLA.	(,, ,,) - -	13
ORTHOPTERA.	(,, ,,) - -	2
THYSANOPTERA.	(*J. Maltback*) - - -	1
COPEOGNATHA.	(*Kai L. Henriksen*) - -	1
MALLOPHAGA.	(,, ,,) - -	31
ANOPLURA.	(,, ,,) - -	2
PLANIPENNIA.	(,, ,,) - -	1
TRICHOPTERA.	(,, ,,) - -	17
LEPIDOPTERA.	(*Niels L. Wolff*) - -	32
COLEOPTERA.	(*August West*) - - -	156
SIPHONAPTERA.	(*Kai L. Henriksen*) - -	2

No species peculiar to the Faroes are comprised in this list, but some remarkable endemic variations, especially in the Lepidoptera, are met with in the insect fauna of the Islands. Thus the majority of the males of the abundant Ghost Moth, ***Hepialus humuli*** Linn., as shown by a fine series in the Oxford University Museum collected on Borö by Mr. N. Annandale in 1890, are curiously intermediate in colour and marking between the well-known variety

hethlandica Weir from Shetland and the ordinary white form which is also present. Other conspicuous departures from the normal are found in the Faroese forms of certain Geometrid moths, as in *Cidaria munitata* Hübn., *C. designata* Hufn. (subsp. *faroensis* Wolff), *Eupithecia satyrata curzoni* Gregs. (ab. *trifasciata* Wolff.), *E. nanata* Hübn. (subsp. *zebrata* Wolff), etc. There are almost certainly no resident butterflies in the Faroes, but those well-known migrants *Vanessa cardui* and *V. atalanta,* whose wanderings extend even at times to Iceland, have been observed on several occasions. Some species of insects, as in Iceland, occur in great profusion; as an instance Wolff writes thus of *Cidaria* (*Emmelesia*) *albulata* Schiff.: 'Thousands of this Lepidopteron swarm on cloudy warm days, standing like clouds of dust over the grass fields.' The common earwig *Forficula auricularia* Linn. is abundant, though it appears not yet to have extended its range to Iceland; and the immense swarms of our familiar 'daddy-long-legs,' which appear in late summer, have been noted by more than one non-entomological visitor to the Islands.

The first list of Faroese Coleoptera of any importance was published in 1881 by Dr. H. J. Hansen (1), and included the names of sixty-five species of the Order. In 1890 the Rev. F. A. Walker (2) recorded eleven species taken on flying visits to the islands in the previous year, and in 1900 Dr. D. Sharp (3), who appears not then to have been aware of Hansen's paper, published in this Magazine a list of twenty-nine species of beetles, collected near Thorshavn, the principal town of the Faroes, by Mr. N. Annandale in June of that year. In our following volume Dr. O. M. Reuter (4) draws attention to Hansen's list, and adds the species not enumerated by Dr. Sharp, thus bringing the total number of Faroese Coleoptera then known to seventy-four or seventy-five species. The results of another small collection made by Dr. Annandale in August, 1903, comprising twenty-three species, four of which were new to the island fauna, are given by Dr. Sharp (5) in our volume for that year. I. C. Nielsen (6) in 1908 adds thirteen species from the collections of Warming and Hansen, B. Poppius (7) records in 1909 twenty-eight species collected by W. Klinckowstroem, and K. Holdhaus (8) forty-four species collected by Dr. R. Görgei and Dr. F. Cornu in 1911. Lastly, E. Mjöberg (9) gives a valuable list of seventy-nine species collected by Klinckowstroem in 1915, thus making a total of 117 species of Coleoptera recorded up to the date of his paper from the Faroe Islands.

The masterly treatise by Dr. August West (10) on the Faroese

Coleoptera, as known up to the year 1930, gives ample details of the occurrence and distribution in the islands of 156 species, all of which are found in the British Islands, and are referred to twenty-three families as follows:—

Carabidae	26 spp.	Dermestidae	3 spp.
Haliplidae	1 ,,	Byrrhidae	3 ,,
Dytiscidae	7 ,,	Elateridae	1 ,,
Staphylinidae	65 ,,	Helodidae	1 ,,
Scydmaenidae	1 ,,	Cantharidae	1 ,,
Silphidae	3 ,,	Anobiidae	3 ,,
Ptiliidae	1 ,,	Ptinidae	3 ,,
Scarabaeidae	3 ,,	Tenebrionidae	1 ,,
Hydrophilidae	8 ,,	Cerambycidae	2 ,,
Cryptophagidae	8 ,,	Chrysomelidae	1 ,,
Lathridiidae	1 ,,	Curculionidae	12 ,,
Coccinellidae	1 ,,		

It will be interesting to compare this total with the number of species recorded up to the same date from the two nearest regions, viz. the Shetland Islands (232 species) and Iceland (141 species).

The families of Coleoptera which are represented by the greatest number of species are the Carabidae, Dytiscidae, Staphylinidae, Hydrophilidae and Curculionidae, and as many as twenty-one species of the genus *Atheta* have been recorded from the Faroes. Some of these, as is the case with the Lepidoptera, are met with in unexpected numbers, and some, *Nebria gyllenhali,* for instance, range from sea-level to the highest mountain summits. Among the most abundant and characteristic beetles of the islands are *Nebria iberica* Oliv. (its near ally *N. brevicollis* Fab. does not appear to occur in the Faroes), *N. gyllenhali* Schön., *Notiophilus biguttatus* Fab., *Trechus obtusus* Er., *Patrobus septentrionis* Dej., *P. assimilis* Chaud., *Calathus fuscipes* Goeze, *C. melanocephalus* var. *nubigena* Hal., *Hydroporus pubescens* Gyll., *Agabus solieri* Aubé, *Tachinus rufipes* De Geer, *Aphodius lapponum* Gyll., *Cercyon haemorrhoidalis* Fab., *Cryptohypnus riparius* Fab., *Chrysomela staphylea* Linn. and *Otiorrhynchus arcticus* Ol. Certain familiar beetles which follow mankind everywhere have in due course made their way to the Faroes, but the two recorded Longicorns, *Callidium violaceum* Linn. and *Gracilia minuta* Fab., and the weevil *Pissodes pini* Linn. are obviously accidental importations.

In July of last year Messrs. H. G. Vevers and F. C. Evans visited Myggenaes, the western outlier of the Faroes (lat. 62° 0′ N., long. 6° 30′ W.), for the purpose of studying the remarkable avi-

fauna of this remote and little-known island. These gentlemen made a small collection of sixty-eight specimens of Coleoptera referable to fourteen species, which is deposited in the Entomological Department of the Oxford University Museum, and is of special interest, as very few insects have as yet been recorded from Myggenaes. The species, most of which were found under small stones and in and about the burrows of puffins, are as follows:—

Notiophilus biguttatus Fab. (1), *Nebria iberica* Oliv. (1), *N. gyllenhali* Schön. (22), *Loricera pilicornis* Fab. (4), *Amara aulica* Panz. (2), *Calathus melanocephalus* var. *nubigena* Hal. (3), *Trechus obtusus* Er. (2), *Patrobus** (12 specimens which have been critically examined by Dr. K. G. Blair, who refers them all to *septentrionis* Dej.), *Megasternum boletophagum* (1), *Tachinus rufipes* De Geer (5), *Lesteva sharpi* Rye (1), *Choleva watsoni* Spence (3), *Otiorrhynchus arcticus* Ol. (7) and *O. dubius* Stroem (1). Of these, *Choleva watsoni* is not included in Dr. West's list, and is therefore presumably new to the Faroese fauna.

The late Dr. D. Sharp, in the pages of our Magazine (Vol. XXXIX, p. 250), concludes his second paper on the Coleoptera of the Faroe Islands with the following remarks: ' I shall not be surprised if the number of species actually in the islands will ultimately prove to be as many as two hundred. A resident naturalist who can take advantage of good weather at different seasons is essential to the acquisition of complete knowledge on this point.'

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* On this genus Dr. Sharp (5, p. 250) remarks as follows—' We do not know enough of the (Faroese) fauna as yet to enable us to deal with the question of variation and other matters of biological interest. It will however be of considerable interest to examine the question of flightlessness. From this point of view the *Patrobi* will be of special interest, as in this genus the wings are in different stages of atrophy according to the species. Do these insects correspond in the extent of this atrophy with the same species on the mainland?

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Summertown, Oxford.
March 16th, 1938.

26

A NEW SPECIES OF THE SPHECID GENUS *DIODONTUS* OCCURRING IN BRITAIN.

BY G. M. SPOONER, M.A.

Reprinted from 'The Entomologist's Monthly Magazine,' Vol. lxxiv.

The existence in this country of a second species of *Diodontus* with yellow mandibles, allied to *minutus* (F.), has been known for many years; but owing to its scarcity in collections and the uncertainty regarding the characters of the female sex, its true identity has remained in doubt. E. Saunders (1910) introduced the species to the British list as *D. friesei* Kohl — a North African form — on the strength of two males which had then recently been captured in Surrey, and three males of unknown locality from Shuckard's collection. These, with other males from Jersey, were characterised by having the intermediate basitarsus only feebly expanded at the apex, that joint appearing almost normal in contrast to its peculiar form in *minutus*.

Since that time little more has been heard of Saunders' supposed *friesei*. Dr. R. C. L. Perkins had informed me that he suspected its occurrence in the New Forest, and I now find that in his collection, housed in the Oxford Museum, three New Forest females had been separated from *minutus* under the other name. The male was rediscovered at Hampstead in 1925 by Dr. O. W. Richards. There have also been suspicions that Saunders' identification was at fault: F. D. Morice, for example, queried the name on labels in the British Museum collection and on one of his own specimens. Moreover, the occurrence of *friesei* in Western Europe has been ignored in the revised edition of Schmiedeknecht's keys for European Hymenoptera (1930). The two authenticated Western and Central European species of flavous-mandibled *Diodontus* have remained, as when Kohl published his work on Palaearctic species, the widespread *minutus* and the Austrian *major*.

It is at last, however, possible to give an adequate description of the problematical British species, based on specimens collected during the past few years in Dorset, on Southhaven Peninsula, near Studland. In this locality it has proved fairly common, burrowing in sandy banks on Bagshot Sand formation. A recent critical examination of a series of fifteen females (taken on various dates between June 13th and July 30th, 1930-37, and one on September 11th, 1938) revealed certain characteristics which in themselves were enough to suggest specific distinction from *minutus*, even if no males had been available to establish the point. The two males secured have proved identical with the actual specimens assigned to *friesei* by Saunders, and the females agree with those from the New Forest attributed to Saunders' species by Dr. Perkins.

Meanwhile reference to Kohl's descriptions and comparison with material in the British Museum collections revealed that both sexes differ in important respects from *friesei* (see below), and, as may well have been expected, cannot possibly be attributed to that Mediterranean species. It proves equally impossible to assign them to *major*, the only species of the group other than *minutus* previously known from temperate Europe. There appears, further, to be no other Mediterranean or W. Asiatic species with which the British specimens can be matched. It must evidently be regarded as new, and in the description which follows the name *insidiosus* is brought forward.

Useful additional material of *D. insidiosus* has been discovered in the collections at the British Museum and the Hope Museum,

Oxford: altogether 13 ♂♂ and 27 ♀♀ have been examined. The specific characters have been determined through a careful comparison with *minutus* and are described on that basis. Of the commoner species the material examined practically covers its whole range in Britain. It is interesting to notice that all four specimens which have survived from Shuckard's collection belong to *insidiosus*, and one of each sex was selected by Saunders as his type of *minutus* ! Shuckard's description of *minutus* (1837, p. 185) also indicates that, for the female at least, he had *insidiosus* before him, since he states that the anterior tibiae have a black marking. Of twenty-seven of Saunders' own specimens the only example of *insidiosus* is a female originally given to V. R. Perkins as an example of *minutus*.

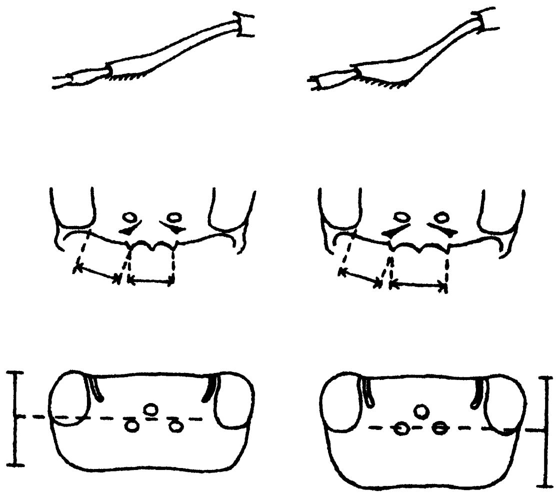

FIG. 1.—Specific distinctions between *Diodontus insidiosus* (left) and *D. minutus* (right). Above, intermediate basitarsus of male; centre, lower part of face of female showing spacing of the clypeal spines; below, outline of dorsal view of head of female.

Diodontus insidiosus sp. nov.

Diodontus minutus Shuckard 1837, nec Fabricius.
Diodontus friesei ♂, E. Saunders 1910, nec Kohl 1901.

Description.

A small species with flavous mandibles, head and mesonotum with finely rugulose surface between the punctures, flagellum of

antenna in the male pale beneath, resembling *minutus* (F.) except for the following distinctions:—

♂. Intermediate basitarsus as in *D. friesei*: gently curved, and slightly but gradually widened towards the apex (not abruptly and strongly expanded as in *minutus*) (Fig. 1).

Tibiae with black markings: anterior and intermediate tibiae with a black mark posteriorly; posterior tibiae mainly black, only the base and apex testaceous or, more rarely, flavous. (In *minutus* the tibiae are mainly, often entirely, flavous: at most the areas black in *insidiosus* are somewhat infuscated, and sometimes the posterior tibiae are black centrally.)

Antennal joints broader: the third joint almost square in outline anteriorly, and rather shorter relative to the fourth than in *minutus*.

Punctures on the upper part of the face on the whole firmer and more clearly differentiated on the rugulose surface.

Angle between the ocelli obtuse: in *minutus* the angle is variable, but is typically a right-angle or acute.

Propodaeum posteriorly with more irregular sculpture, lacking the well-defined reticulation of *minutus* and other species.

♀. Clypeus with spines of anterior margin more closely approximated: distance between the two outer spines somewhat less than that between one of them and the margin of the neighbouring eye: in *minutus* the former tends to be greater (Fig. 1).

Legs darker: anterior tibiae flavous with a black spot posteriorly; intermediate tibiae usually mainly black, but the testaceous area of the apex and base may extend the whole length of the anterior surface; intermediate basitarsi usually black; posterior tibiae black, at most testaceous at apex and base. (In *minutus* anterior tibiae often entirely pale; intermediate and posterior tibiae pale, with a variable amount of darkening centrally; intermediate basitarsi wholly, or at least partly, testaceous. Darkest specimens hardly differ from the palest of *insidiosus*, but there is considerable difference in the average condition.)

Temples somewhat narrower. When the head is viewed from above (Fig. 1) a line equidistant from the anterior and posterior margins passes between the ocelli, whereas in *minutus* it passes through the posterior ocelli; median width of vertex is not greater than half the breadth across the eyes.

Posterior ocelli wider apart: the distance between their mid-points approximately equals that between one of them and the margin of the neighbouring eye (in *minutus* this distance is decidedly less).

Punctures on the head stronger, particularly on the face between the eyes.

Propodaeum on posterior face appears smoother: the reticulations are ill-defined instead of forming a distinct closed network; irregular ridges tend to radiate from the central depression.

Size more uniform, on average smaller, not attaining the upper limit of the more variable *minutus*.

Type. Two of the ♀♀ from Southhaven, Dorset (24.vii.33 and 13.vi.34), have been deposited in the British Museum as type specimens.

Distribution.

In Britain known from Surrey (Chobham, Oxshott), Hants

(New Forest), Dorset (Southhaven Peninsula), Middlesex (Hampstead Heath), Kent (Deal), and Sussex (Seaford). It appears to be confined to these south-eastern counties, frequenting sandy habitats on the Tertiary heaths and, more rarely, on the coast. This range resembles, for example, that of *Halictus perkinsi* and the genus *Miscophus*. In Surrey it is evidently much scarcer than *minutus*. There, and in the New Forest, the two species probably occur together. In Dorset, curiously, neither species has been recorded from the whole extent of the Tertiary heath area, with the exception of the occurrence of *D. insidiosus* in the S.E. corner near Studland: *minutus* is plentiful locally in the county, but only on the coast. The records for Kent and Sussex are based on single females taken last century. It is perhaps remarkable that such a considerable proportion of the species should occur among specimens of '*minutus*' surviving from collections dating about a hundred years back. Thus all four from Shuckard's and eight out of fourteen from Westwood's collection (Oxford Museum) are *insidiosus*. It suggests that the species was at one time more numerous.

Channel Islands: Jersey, Guernsey (Luff, 1907; as *friesei* apud E. Saunders).

Specimens examined.

([1] = coll. Brit. Mus.; [2] = coll. Oxford Mus.; [3] = coll. O. W. Richards; [4] = coll. G. M. Spooner.)

D. insidiosus. Surrey: Chobham, 7-78 (E. Saunders), 1 ♀[4]. Kent: Deal, 13-8-91 (A. J. Chitty), 1 ♀[2]. Middlesex: Hampstead Heath, 9-7-25 and 2-7-26, 2 ♂♂[3]. Sussex: Seaford, 9-9-81 (F. D. Morice), 1 ♀[2]. Hants: New Forest, 7-00 (D. Sharp), 1 ♀; 22-7-06 (G. Arnold), 1 ♀; 14-7-09 (G. Arnold), 1 ♀: these in coll. R. C. L. Perkins, separated as '*friesei*'[2]. Dorset: Southhaven Peninsula, June to September, 1930-38, 2 ♂♂ and 15 ♀♀[4]. Britain, localities unknown: 3 ♂♂ and 1 ♀ (Shuckard)[1]; 4 ♂♂ and 4 ♀♀ (Westwood)[2]; 1 ♂ and 1 ♀ (ex coll. Ent. Club)[2]; 1 ♂ (Capron) (ex coll. Morice)[2]. Channel Is.: Jersey (E. Saunders), 2 ♂♂[1].

D. minutus. Surrey: Chobham, 1 ♂[4] and 3 ♀♀[1 & 2]; Woking, 12 ♂♂ and 17 ♀♀[1, 2 & 4]; Oxshott, 6 ♂♂ and 18 ♀♀[3]; Mitcham Common, 5 ♂♂ and 3 ♀♀[3]; Weybridge, 1 ♂ (coll. Swale)[1]; Wisley, 3 ♀♀[2]. Kent: St. Margaret's, 10 ♂♂ and 7 ♀♀[2]; Huntingfield, 1 ♀[2]; Westgate, 1 ♂[2]; Camber, 3 ♂♂ and 4 ♀♀[3]; (Blackheath, 2 ♀♀)[2]. Middlesex: Hampstead Heath, 1 ♂[3]. Sussex: Hastings, 1 ♀[1]. Hants: Hayling I., 2 ♂♂ and 2 ♀♀[1]; Bournemouth, 4 ♂♂ and 1 ♀[1 & 2]; Sway, 1 ♂[2]; New Forest, 1 ♂[2]. Isle of Wight: St. Helen's, 4 ♀♀[1 & 2]; Sandown, 1 ♂ and 8 ♀♀[2 & 3]. Dorset: Weymouth, 3 ♂♂ and 4 ♀♀[4]; Portland, 4 ♂♂[4]; Lyme Regis, 1 ♀[2]. Devon, S.: Budleigh Salterton, 1 ♂[2]; Dawlish, 6 ♂♂ and 1 ♀[2]; Chudleigh, 2 ♂♂[4]; Bovey Tracey, 2 ♂♂[2]; Trusham, 3 ♂♂ and 1 ♀[2]. Devon, N.: Braunton Burrows, 2 ♂♂ and 5 ♀♀[4]. Berks: Wellington College, 1 ♂[2]. Beds:

Sandy, 1 ♂[4]. Suffolk: Bury St. Edmunds, 1 ♂[2]. Warwick: Hillmorton, 1 ♂ and 2 ♀♀[2]. Cheshire: Wallasey, 3 ♂♂[2]. Merioneth: Barmouth, 5 ♂♂ and 3 ♀♀[1]. Britain, locality unknown: 4 ♂♂ and 2 ♀♀ (ex Westwood coll.)[2]; 7 ♂♂ and 14 ♀♀ (ex coll. F. Smith)[2]; ♂ and ♀ (ex coll. Rothney)[2]; 3 ♂♂ (Capron)[2]; 4 ♂♂ and 2 ♀♀[1 & 2]. France: Cassis, Bouches-du-Rhône, 4 ♂♂ and 6 ♀♀[3]; St. Enimie, Lozère, 1 ♀[3]; Tarascon, Bouches-du-Rhône, 1 ♀[3].

D. insidiosus is at once told from *friesei* Kohl by the minute rugulosity of the surface of the mesonotum, which in the latter species is quite smooth and shining between the punctures, and by the darker legs, which in *friesei* are quite as pale as in *minutus*. Further, the third joint of the antenna in the male of *friesei* is more elongate, being at least as long as the fourth joint. The female of *D. major* (the male being uncertain), while agreeing with *insidiosus* in the spacing of the clypeal spines and stronger puncturation, differs in some important respects. Thus the antennal joints are rather more elongate, especially the third, which is twice as long as wide at apex, as against about one and a half times in *minutus* and *insidiosus* (see Kohl's figures, 1901); while the extent of flavous colouring on the legs, the thickness of the temples and the sculpture of the propodaeum resemble *minutus* in the respects in which they differ from *insidiosus*. Moreover, *major* is a larger species, the range of the female apparently exceeding even the upper limit of *minutus*.

I should like to express my gratitude to the staff of the British Museum, especially Mr. J. F. Perkins, for the facilities always readily given me for examining the national collections or consulting literature. My best thanks are also due to Dr. B. M. Hobby for the help given me in examining the collections in the Hope Department at Oxford, and to Dr. O. W. Richards for the kind loan of his specimens.

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The Brown House,
Weymouth.
September, 1938.

27

[*Reprinted from The Proceedings and Report for 1935 of the Ashmolean Natural History Society of Oxfordshire.*]

Report on Oniscoidea (Woodlice).

Three species of woodlice not hitherto known to occur in the Oxford district have been taken since the publication of my preliminary list of the Oxford species (1935, *Proc. Ashmol. Nat. Hist Soc.*, **1934**: 19-22). *Porcellio laevis* Lat., one of the largest British species, was found in the garden of St. John's College, Oxford, 7.v.1935, by Mr. R. B. Freeman. Later in the year, 21.x.1935, the Rev. Professor L. W. Grensted took it in a garden off Woodstock Road, Oxford, where it occurred in numbers in a rubbish heap.

The somewhat rare *Porcellio rathkei* Brandt was collected near Hen Wood on Boar's Hill, Berks, 25.i.1936, by Mr. E. W. Aubrook, who obtained two specimens from a grass tuft which he was examining for Coleoptera. The following week the writer took it on the Berkshire bank of the Thames above Godstow, where it was associated with *Porcellio scaber* Lat. beneath the bark of an uprooted elm tree. Mr. Aubrook's specimens were submitted to Dr. W. E. Collinge of the Yorkshire Museum, who very kindly confirmed the writer's determination.

All the British species of *Porcellio* have now been recorded from the Oxford district with the exception of *P. ratzeburgii* Brandt, which has, however, been taken near Witney, 14.xii. 1934, in a hedgehog's nest by Mr. D. H. S. Davis.

Armadillidium speyeri Jackson was taken in a glass-house in the Botanic Garden, Oxford, 10.x.1935, by Professor L. W. Grensted. This species was separated from *A. nasatum* Budde-Lund in 1924 by Dr. H. G. Jackson, and it is very probable that most of the records of *A. nasatum* in England should really refer to *A. speyeri*. Dr. E. R. Speyer kindly identified these specimens.

Armadillidium pulchellum Brandt was, owing to an unfortunate oversight, included in the 'Preliminary List.' This species, however, has not yet been observed in the Oxford district and must be deleted.

In his recent paper, 'Woodlice, their Folk-lore and Local Names' (1935, *North Western Naturalist*, **10**: 19-21), Dr. W. E. Collinge records the following additional names in use in Oxfordshire and Berkshire :—

OXON : 'God A'mighty's pigs,' 'Lock-chester,' and 'Thrush louse.'

BERKS : 'Cheese hogs,' 'Cheese pigs.'

Many new locality records for the commoner species of woodlice have been obtained, and the writer is especially indebted to Professor Grensted for much help with these.

ERNEST TAYLOR

(Department of Entomology, Oxford University Museum).

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 10, vol. xx. p. 360, *September* 1937.

Oxford University Expedition to North-East Land, 1936.—*Diptera*. By F. W. EDWARDS. *With a Note on the Pupa of* Orthocladius conformis *Holmgr. by* AUG. THIENEMANN.

DURING the course of the Oxford University Expedition to North-East Land in 1936 a small collection of Diptera was made by Mr. D. B. Keith and submitted to me for determination. The collection comprised the following specimens, which have been divided between the British Museum and the Hope Department of Entomology, Oxford University Museum.

Mycetophilidæ.

Sciara ? *tridentata* Rübs.—1 ♀. Murchison Bay.
Sciara spp. indet. (2).—3 ♀. Brandy Bay.

Chironomidæ.

Diamesa arctica Boh. (*poultoni* Edw.).—9 ♂, 9 ♀. Russian I.; Brandy Bay.

Metriocnemus ? *obscuripes* Holmgr.—4 ♂. Russian I.; Brandy Bay.

Spaniotoma (*Orthocladius*) *consobrinus* Holmgr.—2 ♂, 4 ♀. Russian I.; Murchison Bay.

Spaniotoma (*Orthocladius*) ? *conformis* Holmgr.—2 ♂ pupæ. Russian I.

Spaniotoma (*Smittia*) *brevipennis* Holmgr.—1 ♀. Brandy Bay.

Spaniotoma (*Smittia*), sp. indet.—4 ♀. Brandy Bay.

Tanytarsus (*Lauterbornia*) *gracilentus* Holmgr.—2 ♂, 2 ♀. Murchison Bay.

Trichoceridæ.

Trichocera ? saltator Harr.—5 ♀. Brandy Bay.

Muscidæ.

Limnophora (*Spilogona*) *megastoma* Bohem.—2 ♂, 2 ♀. Brandy Bay.

Of these twelve species the most interesting is *Orthocladius ? conformis* Holmgr., two ripe pupæ of which were found in a freshwater tarn on July 23. So far as could be ascertained the adults dissected from these pupæ belong to *O. conformis* as previously determined and figured by me (Ann. & Mag. Nat. Hist. (9) xiv. pp. 168 & 171) from specimens from Waigat Island, N.E. Spitsbergen; the hypopygial structure is apparently the same, but there is a slight difference in the antennæ which may be significant, the present specimens having the antennal ratio under two, whereas in the Waigat I. specimen it was nearly three *.

I submitted the two pupæ with enclosed adults to Prof. Aug. Thienemann, who has compiled the description which follows. His conclusion that this pupa belongs to the genus or subgenus *Diplocladius* is surprising, because the adult certainly has the characters of *Orthocladius* s. str. (bare eyes, fringed squama, single ♂ style) and not of *Diplocladius* (hairy eyes, bare squama, double ♂ style) as understood by Kieffer and myself. With the discovery of instances such as this where the adult and pupal (or larval) characters seem to provide definite but contradictory evidence of relationship, it is becoming increasingly difficult to frame a harmonious system of classification which shall take account of all the facts.

* Goetzhebner ('Skrifter om Svalbord og Ishavet,' liii. p. 25; 1933) has described a new species *Orthocladius* (*Chætocladius*) *natvigi*, from Franz Josef Land, which may well be the same as the present form, as he says "semblable à *O. conformis* Holmgr., mais AR=2 au lieu de 3."

In my view such cases as this tend to confirm the conclusion that a return should be made to a wider conception of generic limits.

Die Puppe von Diplocladius (Orthocladius) conformis (*Holmgren*). Von August Thienemann, Plön.

Herr F. W. Edwards (London) sandte mir 2 reife ♂ Puppen, die aus einem Süsswassertümpel des Nord-Ost-Landes von Spitzbergen stammten (leg. D. B. Keith, Oxford University Expedition, Juli 1936), und die er nach dem Hypopygium als zu *Orthocladius conformis* gehörig erkannte. Diese Art war von Holmgren (1869) ebenfalls von Spitzbergen beschrieben worden.

Puppe : Vorn am Kopf 2 warzenartige Vorwölbungen, die etwa so hoch wie breit sind und je eine lange Borste tragen. Prothorakalhorn etwa 9 × so lang als basal breit, abgeplattet keulenförmig, distal etwa doppelt so breit als basal, in ganzer Länge mit einzelnen Spitzen besetzt ; die mediane Kante erscheint auf diese Weise gesägt. Nahtgegend gerunzelt.

Vorderrand der Segmente dorsal wie ventral durch eine scharffe, braune Linie markiert.

Abdominalbewaffnung :

Dorsal auf II–VI ziemlich starke Chagrinspitzen, auf VII (und VIII) sind sie ganz fein. Auf II nehmen diese Spitzchen nur die mediane Partie der analen Hälfte des Seg. ein, auf III dehnen sie sich oral- und lateralwärts weiter aus, auf IV noch weiter, sodass auf IV nur die lateralen Partien und (wie auf III) 2 etwa auf der Mitte des Seg. nebeneinander stehende Fensterflecken frei bleiben. Auf V und VI ist die Spitzenpartie wieder weniger ausgedehnt, die Fensterflecken sind hier ganz undeutlich. Diese Chagrinspitzen sind analwärts gerichtet ; nur am Hinterrand von III und IV ist ein Querband oral gerichteter Spitzchen vorhanden, das aber vom übrigen Spitzenbesatz nicht getrennt ist. Ausser den Chagrinspitzen trägt der Rücken der Segmente II–VII noch je 10 kurze Börstchen. Ventral sind auf den Segmenten ebenfalls einzelne Börstchen sowie nahe an dem Oralrand ein Chagrin aus ganz feinen Spitzchen vorhanden. Lateral an den Segmenten jederseits 4 Börstchen, die an den hinteren Segmenten länger als an den vorderen sind.

Analsegment (fig.): Jeder Lobus trägt distal 3, blassbräunliche, distal hakenförmig umgebogene Borsten, die etwas kürzer als das Segment sind. Seitenränder der Loben ohne Schwimmhaare, doch finden sich im proximalen Teil jedes Lobus auf der Lateralkante eine Anzahl stachelartiger, dunkler Spitzen, von denen die etwa 8 am meisten proximal stehenden am längsten sind;

Diplocladius conformis. Analende de Puppe, halbseitig. Del. Dr. Fr. Krüger.

auf sie folgen noch einige kürzere, die weiter von einander entfernt stehen als jene. Gegen das Distalende des Lobus erscheinen diese " Spitzen " nur als Runzeln im Chitin. Gonopodenscheiden des ♂ etwas länger als die Loben.

Nach dem Bau der Puppe ist " *Orthocladius* " *conformis* Holmgren allernächst verwandt mit *Diplocladius cultriger* K. und *D. fossarum* K. (vergl. Stettiner Entomol. Zeit. xcvi. 1935, pp. 219–221) ; der Bau des Prothorakalhorns, der Abdominalsegmente wie auch des Analsegmentes sind bei diesen Formen principiell gleich ; allerdings werden die stachelartigen Spitzen am proximalen Teil der Lateralkante des Analsegmentes für *cultriger* und *fossarum* nicht angegeben. Doch sind sie, wie ich mich an meinen Praeparaten überzeugen konnte, hier auch vorhanden, wennschon weniger stark ausgebildet und ganz blass. Doch liegen mir auch Puppenhäute einer *Diplocladiusart* vor, die sonst ganz *cultriger* gleichen, bei denen die dunkeln Stacheln noch kräftiger und zahlreicher sind als bei *conformis* (Holstein. Waterneverstorffer Binnensee, leg. Meuche, 6. iv. 36).

" *Orthocladius* " *conformis* Holmgren muss also sicher in die Gattung *Diplocladius* gestellt werden.

Man kann *conformis* von den Arten *cultriger* und *fossarum* (die nicht zu unterscheiden sind) auf folgende Weise trennen :

Der Rücken der mittleren Abdominalsegmente ist gleichmässig und vollständig mit Chagrin bedeckt, sodass auf jedem Segment nur 2 Paar Fensterflecken frei bleiben	*D. cultriger* K. [und *fossarum* K.
Auch auf den Seg. III–IV ist der Rücken nicht vollständig mit Chagrin bedeckt, sondern es bleiben oral- und lateralwärts Teile der Segmente frei von Spitzen ; innerhalb der mit Chagrin besetzten Fläche 1 Paar Fensterflecken. Arktische Art	*D. conformis* [(Holmgren).

Eine Puppenexuvie, die völlig mit *conformis* übereinstimmt, besitze, ich aus Schwedisch Lappland (Kleiner See bei Kopparåsen, 18. vi. 36).

29

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 10, vol. xx. p. 401, *October* 1937.

Notes on Insects collected in North-west Greenland by the Oxford University Ellesmere Land Expedition, 1934–35. By G. D. HALE CARPENTER, D.M., Hope Professor of Zoology (Entomology) in the University of Oxford. *With Description of a new Species of* Rhamphomyia (*Dipt.*) *by* J. E. COLLIN, F.R.E.S.

THE Oxford University Ellesmere Land Expedition, 1934–35, wintered at Etah in North-west Greenland, making various journeys from this base. The present collection was obtained solely from North-west Greenland, since the Ellesmere Land journeys were not made in the summer.

The character of the country is high arctic, Etah itself being in lat. 78° 20′ N., and Robertson Bay just south of lat. 78°, with Karnaq twenty miles to the south of it.

The table on pp 401–405 indicates whether or no the species here recorded for the Ellesmere Land Expedition have been obtained by previous expeditions from Oxford. In the 1934 (Wordie) column B.=N.E. Baffin Land, G.=N.W. Greenland.

The material which is the subject of this paper, from N.W. Greenland, 1934–35, consists of specimens which are in the Oxford Museum, Hope Department of Entomology, unless a statement is made to the contrary.

	O.U. Ellesmere Land Expedn.	O.U. Spitsbergen Expedn.	Merton Coll. Arctic Expedn.	O.U. Arctic Expedn.	O.U. Greenland Expedn.	O.U. Lapland Expedn.	O.U. Hudson Straits Expedn.	O.U. Arctic Expedn.	Wordie Arctic Expedn. N.E. Baffin Land.		O.U. Arctic Expedn.
	N.W. Greenland. 1934–35.	West Spitsbergen. 1921.	West Spitsbergen and N.E. Land. 1923.	West Spitsbergen and N.E. Land. 1924.	West Greenland, Godthaab. 1928.	Norweg. Lapland. 1930.	Akpatok Island. 1931.	West Spitsbergen. 1933.	N.W. Greenland. 1934.	S.W. Iceland. 1935.	N.E. Land. 1935–36.
LEPIDOPTERA.											
TORTRICOIDEA.											
Eucosmidæ.											
Argyroploce inquietana Wkr.	+	0	0	0	0	0	0	0	0	0	0
PYRALOIDEA.											
Pyraustidæ.											
Pyrausta torvalis Mösch. ..	+	0	0	0	+	0	0	0	+G.	0	0
Pterophoridæ.											
Pterophorus monodactylus Linn.	+	0	0	0	0	0	0	0	0	0	0

PAPILIONOIDEA.											
Nymphalidæ.											
Brenthis chariclea arctica Zett.	+	0	0	0	+	0	+*ob-scurata* Mc.-Lachl.	0	+{B. G.	0	0
Pieridæ.											
Colias hecla Lef.	+	0	0	0	+	0	+	0	+{B. G.	0	0
GEOMETROIDEA.											
Geometridæ.											
Entephria polata punctipes Curt.	0	0	0	0	+	0	+	0	+{B. G.	0	0
—— —— —— near ab. *brullei* Lef.	+	0	0	0	+	0	0	0	0	0	0
NOCTUOIDEA.											
Noctuidæ.											
Anarta richardsoni Curt...	+	0	0	0	0	0	0	0	+G.	0	0
Sympistis zetterstedtii Staud.	+	0	0	0	0	0	+	0	0	0	0
Lymantriidæ.											
Byrdia grœnlandica arctica Zett.	+	0	0	0	0	0	0	0	+G. (larva)	0	0
HYMENOPTERA.											
APOIDEA.											
Bombus arcticus K.	+	0	0	0	+	0	0	0	+G.	0	0

	O.U. Ellesmere Land Expedn.	O.U. Spitsbergen Expedn.	Merton Coll. Arctic Expedn.	O.U. Arctic Expedn.	O.U. Greenland Expedn.	O.U. Lapland Expedn.	O.U. Hudson Straits Expedn.	O.U. Arctic Expedn.	Wordie Arctic Expedn. N.E. Baffin Land.		O.U. Arctic Expedn.
	N.W. Greenland. 1934–35.	West Spitsbergen. 1921.	West Spitsbergen and N.E. Land. 1923.	West Spitsbergen and N.E. Land. 1924.	West Greenland, Godthaab. 1928.	Norweg. Lapland. 1930.	Akpatok Island. 1931.	West Spitsbergen. 1933.	N.W. Greenland. 1934.	S.W. Iceland. 1935.	N.E. Land. 1935–36.
Diptera.											
Nematocera.											
Tipulidæ.											
Tipula arctica Curtis	+	0	0	0	+	0	0	0	+G.	0	0
Mycetophilidæ.											
Bolitophila cinerea Mg.	+	0	0	0	0	0	0	0	0	0	0
Boletina arctica Holmgr. .	+	0	0	0	0	0	0	0	0	0	0
Chironomidæ.											
Genus indet. (specimens fragmentary)	+										
Trichoceridæ.											
Trichocera sp. cf. *regelationis* L.	+	0	0	0	0	0	0	0	0	0	0

BRACHYCERA.											
Empidæ.											
Rhamphomyia hirticula Collin, sp. n.	+	0	0	0	0	0	0	0	0	0	0
ASCHIZA.											
Syrphidæ.											
Platychirus sp. indet., ♀ ..	+	0	0	0	0	0	+	0	0	0	0
ACALYPTERÆ.											
Ephydridæ.											
Scatella stagnalis Fln.	+	0	0	0	+	0	0	0	0	0	0
Cordyluridæ.											
Scatophaga lanata Lndbk..	+	0	0	0	0	0	+	0	0	0	0
Helomyzidæ.											
Leria septentrionalis Coll. .	+	+ (Bear Island).	+	0	+	0	+	+	0	0	0
CALYPTERÆ.											
Anthomyidæ.											
Limnophora (Spilogona) sanctipauli Mall.	+	0	0	0	+	0	0	0	+ G.	0	0
Fucellia ariciiformis Holmgr.	+	0	0	0	0	0	+	0	0	0	0
—— *pictipennis* Beck.....	+	0	0	0	0	0	0	0	0	0	0
Tachinidæ.											
Phormia grœnlandica Zett.	+	0	0	+	+	+	0	0	0	0	0
—— *atriceps* Zett.	+	0	0	+	0	+	+	+	0	0	0

The species were determined by the following experts, to whom the writer is greatly indebted for their kindness:—Lepidoptera Heterocera, Mr. W. T. Tams, Mr. L. B. Prout, Mr. H. Stringer; the *Bombus* by Dr. O. W. Richards; Diptera Nematocera by Dr F W. Edwards; and the other Diptera by Mr. J. E. Collin, who has also furnished a description of a new species. The writer is responsible for the identification of the two butterflies.

Argyroploce inquietana. 5, no detailed locality, June–July 1935 (*G. N. Humphreys*); 3, Karnaq, 28. vi. 35 (*D. Haig-Thomas*); 2, Karnaq, June–July, 1935 (*G. N. H.*). Two specimens have been presented to the National Collection. 5, Etah, June-July, 1935 (*G. N. H.*) *.

This is an interesting record. Mr. H. Stringer, of the Natural History Museum, kindly wrote as follows:—"The type of *Argyroploce inquietana* bears the legend 'Arctic America' only; we have also two examples from Grinnel Land, and, as far as I am aware, these are the only known specimens apart from those from W. Greenland."

Pyrausta torvalis. 3, Etah; 1, Karnaq, 29. vi. 1935 (*D. H.-T.*).

Pterophorus monodactylus. 1, Etah.

Mr. H. Stringer kindly informs me that "this species has been recorded as far north as Siberia, but whether within the Arctic circle I do not know. This is certainly a new northern record for this species."

Brenthis chariclea arctica. 9, Etah; 17, Karnaq, June–July, 1935 (*G. N. H.*); 1, Karnaq, 2. vii. 1935 (*D. H.-T.*); 3, Karnaq, 29. vi. 1935 (*D. H.-T.*).

Colias hecla. 6, Karnaq, June-July, 1935 (*G. N. H.*); 1, Karnaq, 2. vii. 35 (*D. H.-T.*); 1, Etah.

Entephria polata punctipes Curtis, approaching ab. *brullei* Lef.; 2, Karnaq, June-July, 1935.

Anarta richardsoni. 2, Karnaq, 29. vi. 35 (*D. H.-T.*).

Sympistis zetterstedtii. 4, Karnaq, June–July, 1935 (*G. N. H.*).

* These data are replaced for subsequent species by the word "Etah" alone.

Byrdia grœnlandica. 1, Etah; 2, Karnaq, 29. vi. 35 (*D. H.-T.*).
Bombus arcticus. 2, Etah.
Tipula arctica. 2, Karnaq, 29. vi. 35 (*D. H.-T.*); 5, Etah.
Bolitophila cinerea. 1, Etah.
Boletina arctica. 1, Etah.
Trichocera sp. cf. *regelationis.* 11, Etah; 1, no detailed locality, 1. vii. 1935 (*D. H.-T.*).
Rhamphomyia hirticula, sp. n., Collin. 2 ♂♂, 2 ♀♀, Etah
Platychirus sp. indet., ♀. 1, Etah.
Scatella stagnalis. 1, Etah.
Scatophaga lanata. 18, Etah.
Leria septentrionalis. 7, Etah.
Limnophora sanctipauli. 2, Etah.
Fucellia ariciiformis. 1, Etah.
—— *pictipennis.* 1, Etah.
Phormia grœnlandica. 1, Etah; 2, Karnaq, 26. vi. 35 (*D. H.-T.*).
—— *atriceps.* 1, Etah.

Description of Rhamphomyia hirticula, *sp. n.* (Empididæ). By J. E. Collin, F.R.E.S.

Rhamphomyia hirticula, sp. n., ♂♀.

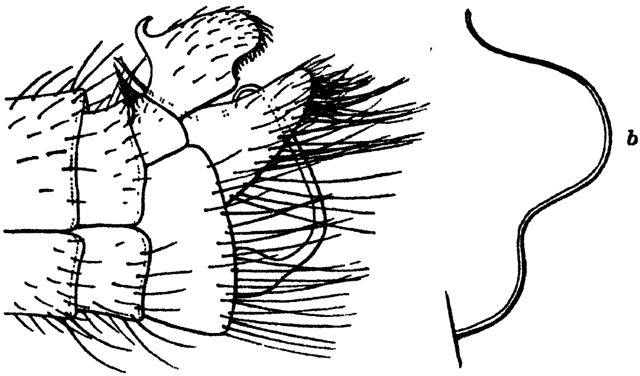
A dark species, more hairy than bristly, closely resembling *R. hirtula* Zett., but smaller and easily distinguished in male by its less slender and differently curved penis, and in both sexes by its chætotaxy.

♂.—Eyes practically touching on frons, with upper facets slightly enlarged; occiput, frons, and the short face dull brownish black. Antennæ dull black, the few hairs on two basal joints shorter than in *hirtula*; numerous occipital curved black hairs also shorter. Palpi black, with long black hairs.

Thorax black, dulled by brownish dust, and when viewed from behind with faint indications of three darker stripes; acrostichals and dorso-centrals long and fine, but not quite so long as in *hirtula*, former biserial, latter not separable from other hairs at sides except behind, where they end in a single row of 4–5 longer stronger bristles; humeral bristle long but fine, 6–8 longer and stronger notopleurals, a postalar, and 8–10 scutellar bristles; sides of prosternum with a patch of long fine

dark hairs, and a smaller patch of shorter hairs on episterna. The dorso-centrals of *hirtula* are at least biserial behind, and scutellar bristles much more numerous.

Abdominal dusting more greyish brown, denser on sternites than on tergites; pubescence not so long as in *hirtula*, especially on last 2–3 segments; hind marginal bristles but little developed, but hind margin of last sternite with numerous long fine bristly hairs, though not quite so long nor so strong as in *hirtula*. Upper lamellæ of genitalia of a similar "boxing-glove" shape to those of *hirtula*, but the thumb-like projection near base above rather longer and more slender; side lamellæ also similar, but the numerous long hairs beneath (or behind) finer; penis stouter, especially on basal half, and with a completely different curvature (fig. *a*).



a. *Rhamphomyia hirticula*, sp. n. End of male abdomen. Curvature of penis shown by dotted lines where hidden by lamellæ.
b. *Rhamphomyia hirtula* Zett. Penis.

Legs black, as in *hirtula* more hairy than bristly, also of similar shape, particularly the four posterior tibiæ rather stouter than front tibiæ, hind tibiæ stoutest and longest and slightly compressed laterally; basal joint of all tarsi comparatively slender, and spinose beneath. The chief points of difference from the legs of *hirtula* lie in the much shorter and less outstanding pubescence above middle and hind tarsi, and the longer bristly hairs beneath end-half of hind femora, especially those of antero-ventral row.

Wings and squamæ somewhat brownish, anal vein complete. Halteres dark brown.

♀.—Resembling male, but frons wide and dull like occiput, eye facets equal, and general pubescence all somewhat shorter. Abdomen tapering behind and ending in a pair of long narrow papillæ which bear only very short pubescence. Differing chiefly from *hirtula* (as in the male) in its smaller size, in having posterior dorsocentrals only uniserial, less numerous scutellar marginal bristles, and longer antero-ventral bristles on end-half of hind femora.

Length about 4 mm.

Described from two pairs in the Oxford University Museum, taken in June or July, 1935, by Dr. G. Noel Humphreys on the occasion of the Oxford University Expedition to Ellesmere Land, N.W. Greenland *.

SPIDERS.

The Ellesmere Land Expedition also collected a few Spiders, the names of which Dr. A. Randell Jackson has kindly furnished :—

Lycosa glacialis Thor. 1 ♂ adult, Karnaq, 26. v. 1935 (*D. H.-T.*).

—— ——. 2 ♂♂, 2 ♀♀ adult, and one young, Karnaq, 11. vi. 35 (*D. H.-T.*).

—— ——. 1 young, Etah.

Erigone arctica White. 1 ♀, Etah.

Also one small example of a female, unidentifiable, and possibly new, and an immature unrecognizable specimen of another species.

* One pair has been presented to the National Collection.—G. D. H. C.

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 10, vol. xx. p. 411, *October* 1937.

Notes on a Collection of Insects made by the Oxford University Arctic Expedition in West Spitsbergen, 1933. By G. D. HALE CARPENTER, D.M., Hope Professor of Zoology (Entomology) in the University of Oxford.

THE Oxford University Arctic Expedition, 1933, carried out investigations and exploration in West Spitsbergen (Svalbard) from a base in Petunia Bay, near the head of Klaas Billen Bay, Icefjord, in the summer of 1933. The expedition contained no entomologist, but arrangements were made for each party to collect specimens according to instructions compiled by Mr. Charles Elton at Oxford, to whom the writer is indebted for these preliminary notes.

Collembola collected by this expedition have already been the subject of a report by Mr. James M. Brown (1936, Ent. Mon. Mag. lxxii. pp. 62–65); there were five species, none new to the district.

A small collection of Acarina was sent to the British Museum (Natural History), but was unfortunately mislaid, and identifications have not been received.

The writer is indebted to Dr. F. W. Edwards and Mr. R. B. Benson, of the British Museum (Nat. Hist.), for kindly identifying the Diptera Nematocera and Sawflies, and to Mr. J. E. Collin for determining the other Diptera. Dr. A. Roman kindly determined the Ichneumonidæ as far as possible.

Information as to capture of each species by other Oxford expeditions is given in the table (pp. 412–413): reference is also made under 1935 to a collection made in South-west Iceland by Miss P. M. Lupton and Miss U. M. Wykes, undergraduates of Oxford. In the 1921 column the letters indicate as follows:—S., Spitsbergen and adjacent islands; B., Bear Island; J., Jan Mayen; G., Greenland; P.C., Prince Charles foreland (island west of Spitsbergen).

	O.U. Arctic Expedn.	O.U. Spitsbergen Expedn.	Merton Coll. Arctic Expedn.	O.U. Arctic Expedn.	O.U. Greenland Expedn.	O.U. Lapland Expedn.	O.U. Hudson Straits Expedn.	Wordie Arctic Expedn.	O.U. Ellesmere Land Expedn.		O.U. Arctic Expedn.
	West Spitsbergen 1933.	West Spitsbergen 1921.	West Spitsbergen and N.E. Land. 1923.	West Spitsbergen and N.E Land. 1924.	West Greenland, Godthaab. 1928.	Norweg. Lapland. 1930.	Akpatok Island. 1931.	N.W. Greenland. 1934.	N.W. Greenland. 1934–35.	S.W. Iceland. 1935.	N.E. Land. 1935–36.
HYMENOPTERA.											
TENTHREDINOIDEA.											
Pristiphora asperlatus Benson	+	0	0	0	0	0	0	0	0	0	0
Pristiphora frigida Benson.	+	+ {S. B.	0	0	0	0	0	0	0	0	0
ICHNEUMONOIDEA.											
Stenomacrus nigricornis Boh.	+	0	0	0	0	0	0	0	0	0	0
Phygadeuon sp. indet. (broken)	+	0	0	0	+ sp. indet.	0	0	0	0	0	0
DIPTERA.											
NEMATOCERA.											
Sciaridæ.											
Sciara sp. indet.	+										
Mycetophilidæ.											
Cœlosia (*Boletina*) *tenella* Zett. (=*setipennis* Holmgr.).	+	+ S.	+	0	0	0	0	0	0	0	0
Exechia frigida Holmgr.	+	+ {S. B. J. ?G.	+	0	+	0	0	0	0	0	0

Chironomus lugubris Zett.	+	+	+	+	0	0	0	0	0	0	0
Chironomus sp. indet.	+										
Smittia sp. indet.	+										
Psectrocladius limbatellus Holmgr.	+	+S.	+	+	+	0	0	0	0	+	0
Cricotopus glacialis Edw.	+	+S.	0	0	0	0	0	0	0	0	0
Diamesa sp. indet.	+										
Culicidæ.											
Aëdes alpinus Linn. = *nigripes* Zett.	+	+ { S. G. L. }	0	0	+	*Aedes* sp. not named		+	0	0	0
ACALYPTERÆ.											
Cordyluridæ.											
Scatophaga furcata Say (= *squalida* Mg.)	+	0	0	0	+ var. *varipes* Holmgr.	0	0	0	+	0	0
Scatophaga nigripes Holmgr.	+	0	0	0	0	+	0	0	+	0	0
Phycodromidæ.											
Fucomyia frigida Fln.	+	+ { B. P.C }	+	+	0	0	0	0	+	0	0
Helomyzidæ.											
Leria septentrionalis Coll.	+	+B.	+	0	+	0	+	0	0	0	0
Calypteræ.											
Anthomyidæ.											
Limnophora triangulifera Zett.	+	0	0	0	0	0	0	0	0	0	0
Limnophora megastoma Bohem.	+	+ { B. P.C. }	+	0	0	0	0	0	0	0	+? (identity doubtful).
Tachinidæ.											
Phormia atriceps Zett.	+	0	0	+	0	+	+	0	+	0	0

The Spitsbergen material submitted for determination consisted of the following specimens, which are in the Hope Department of Entomology, Oxford University Museum :—

Pristiphora asperlatus. 1 ♀ in spirit. Treurenberg Bay, 13. vii. (*O. Gatty*).

Pristiphora frigida. 2 ♂♂ mounted. Treurenberg Bay, 14 & 16. vii. (*O. Gatty*).

Stenomacrus nigricornis. 2 ♀♀ mounted. Treurenberg Bay, 16 & 20. vii. (*O. Gatty*).

Phygadeuon sp., incomplete specimen. On *Dryas octopetala*, Klaas Billen Bay, Petunia Bay, Bruce City, 10. ix. (*O. Gatty*).

Sciara sp. indet. 1 mounted. Treurenberg Bay, 15. vii. (*O. Gatty*).

Cœlosia tenella. 1 ♂, 1 ♀ in spirit. On vegetation, 60 feet above sea-level, Treurenberg Bay, 5. ix. (*O. Gatty*).

Exechia frigida. 1 ♀ in spirit. On vegetation, Klaas Billen Bay, 5. ix. (*O. Gatty*). 1 mounted specimen, doubtfully determined, Treurenberg Bay, 60 feet above sea-level, 16. vii. (*O. Gatty*).

Chironomus lugubris. 7 ♂♂, 4 ♀♀, mounted. On hut window, Klaas Billen Bay (*J. M. McC. Fisher*).

Chironomus sp. Several in too poor condition for identification, Treurenberg Bay, 13 & 15. vii. (*O. Gatty*).

Smittia sp. indet. Several in spirit. On window of hut, Klaas Billen Bay, 8. vii. (*J. M. McC. Fisher*). 1 ♀ in spirit, from vegetation, Klaas Billen Bay, 5 ix. (*O. Gatty*).

Psectrocladius limbatellus. A number in spirit. On hut window, Klaas Billen Bay, 16. vii. (*J. M. McC. Fisher*).

Cricotopus glacialis. As last, but 18. vi.

Diamesa sp. indet. 1 ♀, as last, but 8. vii.

Aëdes alpinus. 108 ♀♀, as last, but 16. vi.

Scatophaga furcata. 2 ♂♂, Klaas Billen Bay, 20 & 31. vii. (*A. R. Glen*). 1 ♂, Treurenberg Bay, on human dung, 16. vii. (*O. Gatty*).

Scatophaga nigripes. 3 ♂♂, and one not fully developed ex pupa. On stones and sea-weed, Klaas Billen Bay, 5. ix. (*O. Gatty*). Also 5 puparia from among seaweed and under stones, with same data.

Fucomyia frigida. 1 ♂. Klaas Billen Bay, 28. vii. (*A. R. Glen*).

Leria septentrionalis. 1 ♀. Treurenberg Bay, 60 feet, 14–16. vii. (*O. Gatty*).

Limnophora triangulifera. 1 ♂. As last.

Limnophora megastoma. 1 ♂. As last, but 20. vii. 1 ♀, north of Treurenberg Bay, Rosen Mts., 25. vii. (*O. Gatty*).

Phormia atriceps. 2 ♀♀. Treurenberg Bay, 60 feet, 14–16. vii. (*O. Gatty*). One specimen on a shot duck.

It is convenient also to record here a few specimens taken by N. V. Polunin in August 1933 at Belsound, in another part of Spitsbergen, although they do not belong to material captured by the Oxford University Expedition: *Scatophaga furcata*, 1 ♂; *Scatophaga nigripes*, 1 ♂; *Fucomyia frigida*, 1 ♀. The specimens were received from C. Elton.

31

From the Annals and Magazine of Natural History, Ser. 11, vol. i. p. 529, *May* 1938.

Notes on Insects collected in West Greenland by the Oxford University Greenland Expedition, 1936. By G. D. Hale Carpenter, D.M., Hope Professor of Zoology (Entomology) in the University. *With Descriptions of a new Species of* Angitia (*Hymenoptera*, Ichneumonidæ) *by* A. Roman, *and of* Fannia (*Diptera*, Anthomyidæ) *by* J. E. Collin.

A general account of the expedition will be found in the 'Geographical Journal' for October 1937 (xc. pp. 315–326): a section on Terrestrial Ecology by H. G. Vevers, who collected most of the terrestrial Arthropoda, occupies pp. 329–331, and a section on Marine Ecology is written (pp. 331–332) by D. M. Steven, who collected along the shore: specimens from him are distinguished by D.M.S. in the records. The area concerned is the neighbourhood of the head of Søndre Strømfjord, and Amerdloq Fjord running inland from the coast at the same latitude (67°). One month was spent at Camp Lloyd on Søndre Strømfjord, for brevity's sake referred to as (L.), which is in the continental hilly belt about 24 miles from the Inland Ice at the head of the Fjord. Five weeks were spent at Utorkait (U.) on the Amerdloq Fjord, in the coastal mountainous region, 15 miles east of Holsteinsborg, and near the northern limit of the maritime Arctic climatic régime distinguished by Trapnell.

Careful notes accompanied the specimens, and in order to avoid repeating the minor details they are listed here so that subsequent reference will be by abbreviations.

Utorkait (U.).

- C. Heathland at camp, about sea-level.
- Mr. Moorland heath, near lake.
- Mt. Top of moraine, moraine heath.
- W. Willow scrub.
- P_1. Pools ½ mile from shore-line, about 500 feet elevation.

Camp Lloyd (L.).

- G. Grassland on silt moraine.
- H. Heathland other than silt moraine.
- W. Willow scrub.
- P_2. Pools one mile from shore-line, about 1000 feet elevation.

The specimens here described were presented by the Exploration Club to the Department of Entomology in the University Museum, where they are kept together with other Arctic collections. The identifications have been done by experts in the different groups, to whom warm thanks are given for their kind help : names are in alphabetical order. F. Balfour-Browne ; K. G. Blair ; J. M. Brown ; W. E. China ; J. E. Collin ; F. W. Edwards ; Ch. Ferrière ; H. Hedicke ; Karl Jordan ; F. J. Killington ; F. Laing ; E. Meyrick ; M. Mosely ; L. B. Prout ; A. Roman ; H. Stringer ; W. H. T. Tams.

An endeavour has been made to establish the novelty of certain records for West Greenland. Dr. B. M. Hobby, librarian and assistant to the Professor, gave great assistance by searching for references to Greenland fauna in the 'Zoological Record' back to 1900, and I myself looked through the papers thus found. The following 22 names therefore appear to be new records for West Greenland, and are distinguished by * throughout the paper. The order of classification of the families considered is in accordance with Imms's 'Text-book of Entomology,' third edition, 1934.

New Records.

Aphididæ : *Phenacococcus venustus* Green.
Hemerobiidæ : *Hemerobius* sp. ? *perelegans* Steph.
Limnophilidæ : *Limnophilus ornatus* Bankes.

GELECHIIDÆ : *Phthorimæa charcoti* Meyr.
EUCOSMIDÆ : *Eucosma petalonota* Meyrick, 1937.
TORTRICIDÆ : *Peronea caryosphena* Meyrick, 1937.
LATHRIDIIDÆ : *Corticaria linearis* Payk.
ICHNEUMONIDÆ : *Cratichneumon magus* W. (*clavipes* Moll.)
Phygadeuon sp.
Aniseres lubricus Foerst.
Angitia (*Inareolata*) *laticepus*, sp. n., Roman.
ENCYRTIDÆ : *Microterys tessellatus* Dalm.
PTEROMALIDÆ : *Habrocytus* sp. (genus not previously recorded).
FIGITIDÆ : *Anacharis eucharioides* Dalm.
MYCETOPHILIDÆ : *Sciara consimilis* (Holmgr.) Edw.
Sciara (*Scatopsciara*) *vivida* Winn.
AGROMYZIDÆ : *Liriomyza* sp. nr. *perpusilla* Mg. (genus not previously recorded).
Phytomyza ? *nigra* Mg.
ANTHOMYIDÆ : *Graphomyia picta* Ztt.
Phaonia pallidisquama Ztt.
Fannia bifimbriata, sp. n., Collin.
CERATOPHYLLIDÆ : *Ceratophyllus borealis* Rthsch.

THYSANURA.

Several specimens were sent to Dr. J. Douglas Hood at Rochester University, New York, but he has, unfortunately, not found himself able either to return the specimens or to forward identifications.

COLLEMBOLA.

An account of the Collembola was included by J. M. Brown in his paper "On some Collembola from Iceland and Greenland" in 'Annals and Magazine of Natural History,' (10) xx. pp. 514–520 (1937). His arrangement is here followed, but only names and localities are given.

ARTHROPLEONA

Hypogastruridæ.

Xenylla humicola (O. Fabr.) Tullb.

U. D. M. Steven, numerous specimens.

Onychiuridæ.

Onychiurus arnatus var. *arcticus* (Tullb.).

L. Three specimens.

Isotomidæ.

Folsomia quadrioculata (Tullb.).

L. Two specimens.

Archisotoma besselsi (Pack.).

L. Numerous specimens from silt along the shore at head of fjord, D.M.S.

Entomobryidæ.

Lepidocyrtus cyaneus Tullb.

U. One specimen.

HEMIPTERA.

HETEROPTERA.

Lygæidæ.

Nysius grœnlandicus Zett.

U., Mr. ♂ and ♀ adults on lichens and *B. nana*, 26. vi.
U., Mr. 1 larva on lichen, 26. vi.
U., Mt. 2 larvæ on moraine gravel, 1. vii.
U., Mt. 1 larva on sand, 3. vii.
U., C. Larvæ common on *B. nana*, 2. vii.
U., C. ♂ and ♀ adults on *B. nana*, 2. vii.
U., C. 1 larva on grass-blades, 18. vii.
U., C. Larvæ from sweep of *B. nana*, 19. vii.
L., G. ♂ and ♀ adults mating in grass, 18. viii.

Capsidæ.

Chlamydatus pulicarius (Fall.).

U., Mr. 1 larva on *B. nana* and lichens, 26. vi.
U., Mt. 1 larva on sand, 3. vii.
U., Mt. 2 larvæ from sweep of *B. nana*, undated.

HOMOPTERA.

Jassidæ.

Deltocephalus lividellus (Zett.)

U., Mr. 1 adult on *B. nana* and lichens, 26. vi.
U., C. 1 adult from sweep of *B. nana*, 19. vii.

L., W. 8 adults from sweep of sedge and grass, or under Ptarmigan droppings, 11. viii. 7 adults from sweep of grass, 13. viii.

Psyllidæ.

A number of Psyllidæ were reported upon as follows by Dr. Laing:—"They appear to belong to one species *Psyllia dudai* Sulc, but there is confusion between *nigrita*, *salicicola*, *saliceti*, *dudai*, and allied species."

Aphididæ.

Myzocallis minimus V. d. G.

U., Mt. Immature, from sweep of *B. nana*, birch-lichen mat.

U., Mr. Immature, on *B. nana* and lichens, 26. vi.

I have not found any published record of this species from Greenland, but Dr. F. Laing kindly informs me that "it has turned up in material collected there from time to time."

**Phenacococcus venustus* Green.

L., W. Under Ptarmigan dropping, 1 specimen, 11. viii.

Dr. F. Laing writes: "This specimen, although antennæ are incomplete, I have assigned to *Phenacococcus venustus* Green, known only from Iceland."

Tychæa grœnlandica Rübs.

L., W. 1 specimen, in soil and moss, 11. viii.

Dr. F. Laing writes: "The specimen may remain under this name, but it is quite plainly a Pemphigid, and the name *Tychæa* will not, of course, stand. Until a longer series becomes available for study the status of the species will remain unknown."

Myzus sp. ?

Apterous viviparous ♀.

U., C. 15. vii.

Dr. F. Laing writes: "The specimen is not good, but belongs evidently to the *convolvuli* group."

Coccidæ.

Orthezia cataphracta Shaw.

U., C. On roots of *Chamænarium*, 13. vii.

Neuroptera.

Hemerobiidæ.

**Hemerobius* sp. ? *perelegans* Steph.

L., W. On *Salix*, 11. viii.

Mr. F. J. Killington was unable to assign this single specimen, a female, with certainty to *perelegans*, of which he stated in his "Monograph of the British Neuroptera" (Ray Society, ii. p. 17, 1937) that "Abroad this species is at present known only from one or two localities in Sweden."

Kimminsia (*Boriomyia*) *betulina* (Strøm.).

U., Mt. ♂ 1. Swept from *B. nana*, birch-lichen mat, 28. vi.

U., W. ♂ 1. Swept from top layer of willow scrub, 1. vii.

U., W. ♂♂ 2. Flying over willow scrub, 10. vii.

Killington (*loc. cit.* p. 89) mentions that the Oxford University Museum possesses "a specimen taken in west Greenland (G. Hingston)." There are actually ♂♂ 2, ♀♀ 5, Godthaab Fjord, Kugssuk and Matuola, between 7th and 28th July, 1928, taken by R. W. G. Hingston.

Trichoptera

Limnophilidæ.

**Limnophilus ornatus* Bankes.

U. 1, on *Empetrum* moor, 14. vii.

The specimen has been presented to the British Museum (Nat. Hist.) as a new record for Greenland. Mr. M. Mosely kindly informs me that this species, closely related to the British *L. elegans*, has been recorded from Canada, Alaska, Franconia (N.H.), and Japan.

Apatania arctica Bohem.

U., C. 1, on *B. nana*, 15. vii.

LEPIDOPTERA.

Tineoidea.

Gelechiidæ.

**Phthorimæa charcoti* Meyr.

U., Mt. 3, on *Salix* in birch-lichen mat, 3. vii.

TORTRICOIDEA.

Eucosmidæ.

**Eucosma petalonota* Meyrick, 1937.

L., G. ♀ 1, on *B. nana* and *Salix*, 18. viii.
L., H. ♀ 1, on *B. nana*, 18. viii., ♂♂ 3, 24. viii.

These are the specimens on which Meyrick based his description of the species ('Exotic Microlepidoptera,' 1937, v. p. 157; but "3 ex. (Oxf. Mus.)" should read "5 ex. (Oxf. Mus.)").

Tortricidæ.

**Peronea caryosphena* Meyrick, 1937.

L., G. ♂ 1, on *B. nana* and *Salix*, 18. viii.
L., H. ♂ 1, on *B. nana*, 18. viii.

The specimens on which Meyrick based his description (*loc. cit.*).

PYRALOIDEA.

Phycitidæ.

Laodamia fusca Haw.

U., Mr. 1, on *B. nana*, 18. vii.

Pyraustidæ.

Scoparia centuriella F.

U., W. 1, on *Salix*, 15. vii.
U., Mt. 1, on *B. nana* or *Salix*, birch-lichen mat, 15. vii.
U., W. 1, on *Salix*, 17. vii.

PAPILIONOIDEA.

Nymphalidæ.

Brenthis chariclea arctica Zett.

U. 2, 16. vii.
U., Mr. 4, herb mat, 18. vii.
U., C. 1, visiting *Vaccinium* flowers, 10. vii.
U., Mr. 3, *Empetrum*-birch moor and herb mat, 21. vii.
U., Mr. 2, *Cassiope-Empetrum* mat, *c.* 1000 feet, 21. vii.
U. 1, 22. vii. The right hind wing noted before capture to have its posterior two-thirds missing. The injury suggests the work of a bird.

Pieridæ.

Colias hecla Lef.

U., Mr. 1, *Cassiope-Empetrum* mat, c. 1000 feet, 7. vii.
U., Mr. 2, *Empetrum*-birch moor and herb mat, 21. vii.

GEOMETROIDEA.

Geometridæ.

Entephria polata punctipes Curtis.

U., Mr. 1, *Empetrum*-birch moor and herb. mat, 21. vii.

A rather weakly-marked dark female, approaching ab. *brullei* Lef. All specimens of this species in the University collections from the Arctic were submitted to Mr. L. B. Prout in March 1937, and he kindly allows me to give his views, as follows:—"No definite line can be drawn between the various high-northern forms, though there is, as with most Palæarctic and Nearctic Larantiidæ, considerable variation. There seems to be a tendency for the species to form two ill-defined races: (*a*) *E. polata polata* Dup. (1831), from Scandinavia, parts of N. Russia, etc.; (*b*) *E. polata punctipes* Curt. (1835), founded on a single damaged example brought from Ross's second Arctic expedition, the exact locality for which is unknown, but the form is distributed in Greenland and Arctic America. Of this I must call *brullei* Lefebvre (1836) an 'ab.' or 'ab. loc.,' founded also, probably, on a single specimen, though this is not stated: this was from the 'Pays des Esquimaux.' This form is dark and glossy, rather pointed-winged, the median band either weakly expressed or virtually wanting, as in the nominotypical specimen. Glancing over the whole material again I do notice a tendency for the Greenland forms to be a trifle darker, perhaps particularly on the hind wing, than those from N.E. Baffin Land, but I see no likelihood of reverting to a belief in two differentiable races of *polata*."

Eupithecia gelidata Möschl.

All from Utorkait.

Mt. 7, on *B. nana*, moraine heath, birch-lichen mat, 28. vi.

Mt. 1, on *Salix*, 28. vi.

Mr. 4, on *B. nana* and *Salix*, 29. vi.
C. 1, on *B. nana*, 30. vi.
W. 2, swept from top layer, 1. vii.
W. 1, from "shrub layer," 2. vii.; also 1 of same date, no details.
Mr. 2, on *B. nana*, 10. vii.
Mr. 1, hovering over female *Salix*, 13. vii.
Mr. 1, *Empetrum*-birch moor and herb mat, 21. vii.
Mr. 1, common on *Salix*, 22. vii.

NOCTUOIDEA.

Noctuidæ.

Crymodes exulis Lef.
U. 1, flying by day over *Salix*, 13. vii.

Anarta richardsoni Curt.

U., Mt. 1, sweeping from *B. nana*, birch-lichen mat, sample 5, 5. vii.

Eurois occulta L.

L., G. 4, flying at night, 9. viii.

Epipsilia quadrangula Ztt.

L., G. 2, flying at night, 9. viii.; 1. ditto, 11. viii.

Eumichtis sommeri Led.

L., G. 2, flying at night, 9. viii.

Simpistis zetterstedtii Staud.

U., Mr. 1, from *B. nana* or *Empetrum*, 18. vii.

COLEOPTERA.

ADEPHAGA.

Dytiscidæ.

Hydroporus morio (Dej.) Aubé.

L., P_2. 4, 23 & 27. vi., D.M.S.
U, P_1. 3, 20–22. vii., D.M.S.

Colymbetes dolabratus Payk.

L, P_2. 2, 23 & 27. vi., D.M.S.
U., P_1. 3, 20–22. vii., D.M.S., with three larvæ,

Gyrinidæ.

Gyrinus opacus Sahl.

L., P_2. 4, 23 & 27. vi., D.M.S.
U., P_1. 4, 20–22. vii., D.M.S.

Polyphaga.

Diversicornia.

Lathridiidæ.

**Corticaria linearis* Payk.

L., G. 1, in soil, moss, and silt, 9. viii.

Dr. K. G. Blair, who kindly identified the specimen, wrote that it "occurs in Siberia, but has not been recorded from Iceland, Greenland, or North America."

Coccinellidæ.

Coccinella transversoguttata Fld.

U., Mt. 1, on *B. nana*, birch-lichen mat, 10. vii.
L., H. 1, on *B. nana*, 24. viii.

Byrrhidæ.

Byrrhus fasciatus Forst.

U., C. 1, under stone, 20. vii.

Rhynchophora.

Curculionidæ.

Otiorrhynchus nodosus O. Fab.

U., C. 2, in soil, under stones, and on *B. nana*, 2. vii. and 5. vii.

HYMENOPTERA.

Apocrita.

Ichneumonoidea.

Ichneumonidæ.

Ichneumoninæ.

**Cratichneumon magus* W. (*clavipes* Möll.).

U., W. ♂ 1, by sweep of shrub layer, 14. vii.
U., C. ♀ 1, visiting *B. nana*, 21. vii.

Dr. A. Roman, who kindly identified the Ichneumonoidea, reported :—"The two are small (♀ 5·5 mm., ♂ 6 mm.) and dark. Antennæ of ♀ with no white ring, face of ♂ black with two yellow points near the lower facial angles and two more just below antennal bases, scutellum black. This species has not previously been recorded from Greenland ; the southernmost locality for it seems to be somewhere in France, according to the catalogue of de Gaulle (probably in a mountainous part). In Scandinavia it goes down to our southernmost province, Scania, as *clavipes* Möll., the type of which I have seen in the museum of Gothenburg. It is everywhere a rare species."

Cryptinæ.

Cryptus arcticus Schdte.

U., Mt. ♂ 1, on birch-lichen mat, 27. vi.

"A common species on all the Greenland coast. Not found in Europe."

Phygadeuon cylindraceus Rthe.

U., C. ♂ 1, field layer, 14. vii.

U., C. ♂ 2, visiting *B. nana*, 20. vii.

"Common North European coast species, but occurring also in the Scandinavian mountains. I have seen a ♀ of probably this species from the Austrian Alps (collector, L. Czerny)."

Phygadeuon, sp. A.

U., W. ♂ 1, sweeping of grass, 10. vii.

L., W. ♂ 1, sweeping of grass, 13. viii.

"Seems to be the species reported by me in 1930 (Ann. & Mag. Nat. Hist. (10) v. p. 283) as a single male from Matuola in W. Greenland, July 3rd. At least the characters given in that report fit these specimens, excepting that the stigma emits radius before its centre, but so little that it may fall within the specific amplitude."

**Phygadeuon*, sp. B.

L., W. ♂ 1, sweeping of grass, 13. viii.

"A small specimen of 3·3 mm. length with a rather thick head, not narrowed behind the eyes, but with rounded sides ; clypeus with two marginal granules.

Antennæ thinner than in the last species, which it much resembles in colour and most other characters. Both hind wings are missing." Dr. Roman considers this species new to Greenland.

Gelis terebrator Ratz.

U. ♀ 1, 10. vii.

"Rather common, but the only species known from Greenland."

Pimplinæ.

Pimplidea sodalis Rthe.

U., Mt. ♂ 1, birch-lichen mat by sweeping *B. nana*, sample I, 4. vii.

"A common species on all the Greenland coast. Occurs on almost all European mountains reaching above tree-limit, but is not known from North America."

Itoplectis alternans kolthoffi Auriv.

U., W. ♂ 1, top layer, 1. vii.

"Melanistic form of a common European species. This form occurs also in North Europe and in the smoky industrial part of West Germany, being one of the 'industry melanisms' discovered in later years."

Plectiscus hyperboreus Holmg.

U. ♂ 1, 13. vii. ♀ 1, 20. vii.

"The antennal flagellum of the present ♀ 19-jointed, of the ♂ 20-jointed. Not rare in Greenland nor in North Europe, but in Central Europe only found on the Baltic coast of Germany."

Plectiscus collaris Gr.

U., W. ♂ 1, top layer, 1. vii.

"The specimen has a 20-jointed flagellum. Rarer in Greenland than the last species, but common in North Europe, at least to the Alps."

**Aniseres lubricus* Foerst.

U. ♂ 1, on *Empetrum*, 17. vii.

"Known from Central Europe with England, in Sweden from the Stockholm region. The specimen is typical, with 20-jointed flagellum."

Tryphoninæ.

Banchus monileatus Gr.

U., W. On top layer, ♂ 2, 1. vii.; 1, 2. vii.
U. On *Salix*, ♂ 1, 13. vii.; ♀ 1, 15. vii.; ♀ 1, 16. vii.
U. On *Empetrum*, ♂ 1, ♀ 2, 17. vii.

"This is the commonest larger Ichneumonoid in Greenland, though rare in North and Central Europe."

Homotropus ornatus Gr.

L., W. ♂ 1, on *Salix*, 11. viii.

"Only one ♀ of this species has previously been known from Greenland (Lundbeck). In north and central Europe it is not common, and Morley reports it from the Punjab, N.W. India. The Stockholm Museum owns a conspicuously coloured form taken near the top of one of the Birunga mountains in central Africa."

Homotropus melanogaster Holmg.

U., W. Top layer, ♂ 1, ♀ 1, 1. vii.
U., W. Shrub layer, ♀ 1, 20. vii.

Homotropus elegans nigritarsus Gr.

U., Mt. ♀ 1, birch-lichen mat, sweep of *B. nana*, 4. vii.

"The Greenland form mostly has the lower side of the femora basally with a brown or black spot or line. This is reminiscent of *H. nigrolineatus* Strobl. from alpine localities in Styria, which seems from the description to be about the same form, only still more melanistic. If there is to be a name for it, *grœnlandicus* Holmg. is the oldest one."

Ophioninæ.

**Angitia* (*Inareolata*) *laticeps*, sp. n., Roman.

All from Camp Lloyd.
W. ♀ 1, among humus, 8. viii.
G. ♂♂ 2, on grass, 10. viii.
W. On *Salix*, ♀ 1, 11. viii.; ♂♂ 2, ♀♀ 2, 13. viii.; ♂♂ 3; ♀♀ 4, sweeping from *Salix*, 18. viii.
H. ♂ 1, on *B. nana*, 24. viii.

Dr. A. Roman has kindly sent me the following description:—"♂♀ *Angitia* (*Inareolata*) *exareolata* Ratz. magnitudine et structura simillima, at capite pone oculos ne minime quidem angustato, lateribus supra visis

antice parallelis rectis, postice fortiter rotundata, diversa. Sweden, central Lapland, 1 ♀ (*Boheman*), type; Prov. Småland, 1 ♂ (*Boheman*), allotype. Siberia, Samarova, 1 ♀ (*J. Sahlberg*). Also the specimens above mentioned collected by H. G. Vevers.

"I have not been able to see any other difference from the rather well-known *exareolata* Ratz. than the form of the head, but that is conspicuous when once observed. The ♂ ædeagus may possibly furnish more characters, but until that is known this form would perhaps be better known as a northern race, replacing the more southern, typical one. The place Samarova is situated either at the river Ob or at the river Yenissei. The maps I have seen show only a place Samarovskoje at the big bend in the middle course of Ob, and that may be the same as Samarova in our old locality labels. The subgeneric name *Inareolata* Ell. & Sachll. is simply a substitute for *Diocles* Foerst., preoccupied in the Coleoptera."

Chalcidoidea.

Encyrtidæ.

**Microterys tessellatus* Dalm.

U., Mt. ♀ 1, birch-lichen mat, sweeping of *B. nana*, 28. vi. U., C. ♀ 1, 2. vii.

Dr. Ch. Ferrière, who kindly identified the Chalcidoidea, wrote: "These two are varieties with shorter wings. They agree exactly with the descriptions of *tessellatus*, and I have compared them with specimens of that species in the British Museum (Nat. Hist.), from which they differ only by the shorter wings, which reach only slightly beyond the tip of the abdomen. The second interrupted hyaline band on the fore wings, which is at about two-thirds the length of the wing in normal specimens, is here near the end of the wing and narrower. But I consider these specimens as only a variety of *tessellatus*."

I have found no record of this species from Greenland.

Pteromalidæ.

**Habrocytus* sp.

L., W. ♂ 1, on *Salix*, 13. viii.

Dr. Ferrière was unable to do more than to determine the genus. I can find no previous record for it from Greenland.

Cynipoidea.

Figitidæ.

**Anacharis eucharioides* Dalm.

U., W. ♂ 1, shrub layer, sweep I, 20. vii.

L., W. On *Salix*, ♂♂ 3, ♀♀ 2, 11. viii; ♂♂ 5, ♀ 2, 13. viii.

Dr. H. Hedicke, who kindly identified the specimens, wrote: "They are *Anacharis eucharioides* Dalm., a Figitid widely distributed in the North of Europe, but not yet known from Greenland."

DIPTERA.

Nematocera.

Dr. F. W. Edwards, who kindly identified the Nematocera, added the following general remarks:—"The extension of the known range of some of the species is interesting, and two, *Culicoides sordidellus* Zett. and *Gonempeda caudata* Lbk., had not previously been received at the British Museum. Unfortunately most of the Chironomidæ are represented by a few females only, and cannot be precisely determined. It is noteworthy that at most four of the twenty-three species represented were also found by Mr. D. Lack or Mr. F. S. Chapman in East Greenland in 1933 (Edwards, 1935, Ann. & Mag. Nat. Hist. (10) xv. pp. 467–473)." The arrangement of the families is, for the sake of uniformity, as in Imms's 'Textbook,' 1934.

Tipulidæ.

Tipula arctica Curt.

U., C ♂ 1, on *B. nana*, 30. vi.

Ormosia fascipennis Zett. (*holtedahli* Alex.).

U., C. ♂ 1, 10. vii.; ♀ 1, 18. vii. Generally distributed, or flying over willow scrub.

Gonempeda caudata Lbk.

L., W. ♀♀ 2, willow scrub, on *Salix*, 11. viii.

Trichoceridæ.

(N.B.—This family is not recognized by Imms, who places *Trichocera* in Rhyphidæ at the end of the Nematocera.)

Trichocera ? *lutea* Becher.

U., C. ♀ 1, on *B. nana*, 30. vi.

Culicidæ.

Aëdes nigripes Zett.

U., C. ♀♀ 10, 8. vii. ; 3, 17. vii.

Chironomidæ.

Metriocnemus (s. str.), sp. indet.

U., W. ♀ 1, 1. vii.

Metriocnemus (*Paraphænocladius*) *graminicola* Lbk. (?).

U. ♀ 1, prey of spider, 13. vii.

Cricotopus vitripennis Mg. (*variabilis* Staeg.).

U., W. ♀ 1, swept from top layer, 1. vii.
U., W. ♂ 1 ; shrub layer, ♀ 1, 2. vii.
U., W. ♀ 1, flying over willow scrub, 10. vii.
U., W. ♀ 1, prey of spider, 13. vii.
U., C. ♀ 1, sweep of *B. nana*, 19. vii.

Spaniotoma (*Orthocladius*) sp., cf. *rubicunda* Mg.

U., W. ♀ 1, flying over willow scrub, 10. vii.
U., W. ♀ 1, sweep of shrub layer, 11. vii.
U., W. ♂ 1, on *Salix*, 17. vii.

Spaniotoma (*Orthocladius*) sp., cf. *vernalis* Goet.

L., H. ♀ 1, on *B. nana*, 24. vii.

Spaniotoma (*Orthocladius*), sp. indet.

U., W. ♀ 1, prey of spider, 13. vii.

Spaniotoma (*Limnophyes*) *borealis* Goet.

U., W. ♂ 1, sweep of shrub layer, 13. vii.
U., W. ♂ 5, field layer, in swarms below the level of *Salix*, 15. vii.
U., W. ♂ 1, on *Salix*, 17. vii.

Dr. Edwards comments on this species :—" Goetzghebuer does not mention the rather numerous scales, which are present in the prescutellar area and shoulders in these specimens ; the A.R. is also slightly less than stated by him (1·0 instead of 1·2), but the hypopygium is similar."

Spaniotoma (*Limnophyes*) sp. cf., *minima* Mg.

U., W. ♂ 2, swept from top layer, 1. vii.
U., W. ♂ 1, flying over willow scrub, 10. vii.
U., W. ♂ 1, field layer, 11. vii.
U., W. ♂ 2, sweep of shrub layer, 13. vii.

Dr. Edwards comments: "A rather smaller species than the last, without obvious scales on them, A.R. about 0·7." I have not found a record for *minima* from Greenland.

Spaniotoma (*Smittia*), sp. indet.

U., Mr. ♀ 1, prey of spider, 29. vi.
U., C. ♀ 1, swept from *B. nana*, 19. vii.

Spaniotoma (*Smittia*), sp. indet.

U., W. ♀ 1, swept from top layer, 1. vii.
U., C. ♀ 1, 10. vii.

Ceratopogonidæ.

Culicoides sordidellus Zett.

L., G. ♀♀ 10, biting in swarms after rain, 9. vii.

Dr. F. W. Edwards writes as follows :—" As this species is very little known, I give some additional data to facilitate identification ; it is one of the largest species of the genus, with wing about 2·3 × 1 mm. Eyes narrowly but distinctly separated (by about the width of one facet). Mesonotum grey, without conspicuous markings, but with a pair of somewhat darker patches posteriorly. Spermathecæ two, subglobular (I cannot detect the third rudimentary spermatheca in the specimen mounted). Legs dark, tibiæ not ringed. Wing with macrotichiæ dense on distal half, sparser on basal half. Costa strongly thickened above radial cells, first radial cell very narrow, second rather broader, but about equal in length to first. Markings diffuse and rather indistinct ; about half of second radial cell included in the pale area ; only two small indistinct pale marks in median fork ; cubital fork dark at base, with a pale spot on margin of wing. The species is not included in the recent review of the North American species of *Culicoides* by Root and Hoffman (Amer. J. Hyg. xxv. pp. 150–176, 1937), though their new species *C. gigas* seems to be similar in most respects."

Mycetophilidæ.

Boletina grœnlandica Staeg.

U., W. ♀ 1, flying over willow scrub, 10. vii.

U., W. ♀ 1, field layer, swarms below level of *Salix*, 15. vii.

U., W. ♀ 1, on *Salix*, 17. vii.

Boletina sp., cf. *sciarina* Mg.

U., W. ♀ 1, sweep of shrub layer, 11. vii.
U., W. ♀ 2, shrub layer, 14. vii.
U., W. ♀ 1, field layer, swarms below level of *Salix*, 15. vii.
U., W. ♀ 2, on *Salix*, 17. vii.

**Sciara consimilis* (Holmgr.) Edw.

U., C. ♂ 1, sweep of *B. nana*, 18. vii.

Dr. Edwards writes: "Agrees well with specimens I have examined from Bear Island and Spitsbergen." I have been unable to find this species in previous records of Greenland fauna, though it may possibly have been recorded under another name.

Sciara, spp. indet.

U., C. ♀ 1. prey of spider, 30. vi.
U., W. ♀ 1, field layer, 11. vii.
U., W. ♀ 1, sweep of shrub layer, 13. vii.
U., C. ♀♀ 2, generally distributed, 17. vii.
L., W. ♀ 1, among humus, 8. viii.
L., W. ♀ 1, on *Salix*, 13. viii.

**Sciara* (*Scatopsciara*) *vivida* Winn.

U., C. ♂ 1, 16. vii.

Dr. Edwards writes: "This common European species has been recorded from Iceland, but not from other parts of the Arctic unless (as is probable) one or more of Holmgren's or Lundbeck's names may apply to it."

Simuliidæ.

Simuliium vittatum Zett.

U., C. ♀♀ 4, 8. vii.
U., W. ♀♀ 4, flying over willow scrub, 10. vii.
U., W. ♀♀ 3, shrub layer, 14. vii.
U., W. ♀♀ 3, on *Salix*, 17. vii.

Simulium arcticum Mall.

L., G. ♀♀ 10, in swarms, biting, 9. viii.

BRACHYCERA.

Empididæ.

Rhamphomyia nigrita Zett.

U., C. ♂ 1, ♀ 1, 30. vi.
U., W. ♂♂ 3, ♀ 1, flying over willow scrub, 10. vii.
U., W. ♂♂ 3, ♀ 1, on *Salix* and flying high, 16. vii.
U., W. ♂♂ 2, ♀ 1, on *Salix*, 17. vii.

Dolichopodidæ.

Dolichopus grœnlandicus Zett.

U., W. ♂ 1, shrub layer, 2. vii.
U., W. ♀ 1, field layer, 14. vii.
U., C. ♀ 1, sweep of *B. nana*, 19. vii.
U., W. ♀ 1, shrub layer, 20. vii.
U., C. ♀ 1, 21. vii.

CYCHORRHAPHA.

ASCHIZA.

Phoridæ.

Aphiochæta grœlandica Ldbk.

U., Mt. ♂ 1, birch-lichen mat, sweep of *B. nana*, 28. vi. ; ♂ 1, 2. vii.
U., W. ♂ 1, sweep of shrub layer, 13. vii.
U., W. ♂ 1, field layer, 14. vii.

Syrphidæ.

Platychirus hyperboreus Staeg.

U., Mt. ♂♂ 4, birch-lichen mat, 27. vi.
U., Mr. ♂♂ 2, ♀ 1, on *B. nana* and *Salix*, 29. vi.
U., C. ♂ 1, ♀♀ 4, on *B. nana*, 30. vi.
U., W. ♂ 1, ♀ 1, swept from top layer, 1. vii.
U., W. ♂♂ 3, ♀♀ 2, shrub layer, 2. vii.
U., W. ♂ 1, flying over willow scrub, 10. vii.
U., Mr. ♀♀ 4, hovering over *B. nana*, 10. vii.
U., W. ♀ 1, shrub layer, 14. vii.

U., W. ♀ 1, on *Salix*, 14. vii.
U., Mr. ♀ 1, hovering over *B. nana*, 15. vii.
U., C. ♀ 1, sweep of *B. nana*, 19. vii.
U., C. On *Elymus*, ♀ 1, 19. vii.
U., C. ♀ 1, visiting *Salix* and *Campanula*, 20. vii.
U., C. ♀ 1, visiting *Ledum*, 20. vii.

Melanostoma lundbecki Coll.

U., Mt. ♂ 1, on *Salix*, 28. vi.
U., Mt. ♀ 1, hovering over *B. nana*, 10. vii.

Syrphus tarsatus Zett. var.

U., W. ♂ 1, on *Salix*, 15. vii.
U., Mt. ♀ 1, birch-lichen mat, 27. vi.

Mr. J. E. Collin, who kindly identified the Brachycera, wrote:—"The question of the number of species in the Arctic regions of the *S. luniger* and *S. tarsatus* groups will never be cleared up until someone is sent there who knows something of the problem and how to collect specimens in good condition.

"Among the six males of the *S. tarsatus* group in your material there are indications of four species, and if I could obtain specimens of true *tarsatus* to dissect I could at least prove whether any of them are entitled to be called by that name."

Syrphus ? tarsatus.

U., W. ♂ 1, on *Ledum* and *Salix*, 16. vii.
U., C. ♀ 1, on *B. nana*, 30. vi.
U., W. ♀ 1, visiting *Ledum*.
L., G. ♀ 1, on *B. nana* and *Salix*, 18. viii.

Syrphus, sp. of *tarsatus* group.

U., Mr. ♀ 1, on *B. nana* and *Salix*, 29. vi.
U., C. ♀♀ 4, on *B. nana*, 30. vi.
U., W. ♀♀ 2, swept from top layer, 1. vii.
U., Mr. ♀♀ 2, hovering over *B. nana*, 10. vii.
U., W. ♀ 1, on *Salix*, 15. vii.
U., Mr. ♀ 1, over moss bog foot, 21. vii.

Syrphus arcuatus Fln.

L., G. ♀ 1, on *B. nana* and *Salix*, 18. viii.

Syrphus arcuatus group, near *neoperplexus* Curr.

U., C. ♀ 1, on grass, 8. vii.
U., W. ♀ 1, hovering over *Salix*, 13. vii.
L., W. ♂♂ 2, visiting *Salix* flowers, 11. viii.

Syrphus torvus O. S.

U., W. ♀ 1, swept from top layer, 1. vii.

Sphærophoria strigata Staeg.

U., Mt. ♀ 1, birch-lichen mat, on *Dryas integrifolia*, 25. vi.
U., Mt. ♂ 1, birch-lichen mat, on *Salix*, 28. vi.

SCHIZOPHORA.

Agromyzidæ.

**Liriomyza* sp. near *perpusilla* Mg.

L., H. ♂♂ 2, ♀ 1, on *B. nana*, 24. viii.

Mr. J. E. Collin informs me that he does not think the genus *Liriomyza* has previously been recorded from Greenland. I have found no record.

**Phytomyza* ? *nigra* Mg.

L., H. ♀♀ 3, on *B. nana*, 24. viii.

Ph. nigra does not appear to have been recorded from Greenland.

Cordyluridæ.

Microprosopa hæmorrhoidalis Mg.

L., G. Pair *in copula*, 18. viii.

Scatophaga furcata Say (*squalida* Mg., *varipes* Holmg.).

U., C. ♂♂ 2, ♀♀ 3, on dung, 16. vii.
U., C. ♀ 1, on dung, 18. vii.
L., G. ♂♂ 5, ♀♀ 2, on dung; includes two pairs *in copula*, 10. viii.
L., W. ♂ 1, by sweeping, 11. viii.
L., G. ♂♂ 8, ♀ 1, 24. viii.

Scatophaga nigripes Holmgr.

Males, all collected by D. M. Stevens, Utorkait, on shore, drift-line seaweed, 2, 10. vii.; 1, 12. vii.; 1, 13. vii.; 1, 14. vii.; 1, 15. vii.

Piophilidæ.

Piophila pilosa Staeg.

U., C. ♂ 1, generally distributed, 17. vii.
U., W. ♀ 1, swept from top layer, 1. vii.
U., C. ♀ 1, 3. vii.; 1, 10. vii.; 1, 17. vii.

Piophila vulgaris Fln.

U., C. ♂ 1, ♀♀ 3, generally distributed, 17. vii.
U., C. ♂ 1, ♀♀ 2, generally distributed, 18. vii.

CALYPTERA.

Anthomyidæ.

**Graphomyia picta* Zett.

U., C. ♀ 1, on dung, 18. vii.

**Phaonia pallidisquama* Zett.

U., Mt. ♀ 1, prey of spider, 27. vi.

Limnophora (*Spilogona*) *arctica* Zett.

U., W. ♂♂ 2, swept from top layer, 1. vii.
U., W. ♂♂ 3, ♀ 1, shrub layer, 2. vii.
U., W. ♀♀ 4, flying over willow scrub, 10. vii.
U. ♂ 1, on shore, drift-line seaweed, D.M.S., 12. vii.
U., W. ♀ 1, on *Salix*, 13. vii.
U., W. ♂ 1, on *Salix*, 14. vii.
U., W. ♀ 1, on *Salix*, 16. vii.
U., W. ♂ 1, ♀ 1, on *Salix*, 17. vii.
U., W. ♂ 1, ♀ 1, shrub layer, sweep I, 20. vii.
U., C. ♀♀ 2, 21. vii.
L., W. ♀♀ 4, on *Salix*, 11. viii.; 1, 13. viii.; 2, 18. viii.

Limnophora (*Spilogona*) sp.

U., C. ♀ 1, on *B. nana*, 30. vi.

**Fannia bifimbriata*, sp. n., Collin.

U., W. ♂ 1, ♀ 1, swept from top layer, 1. vii.
U., W. ♂ 1, shrub layer, 2. vii.
U. ♀ 1, on shore, drift-line seaweed, D.M.S., 12. vii.
U., C. ♀ 1, on human dung, 16. vii.

The description of the species, based on the above co-types, is given by Mr. J. E. Collin, as follows:—"Allied to *F. monilis* Hal. and *ciliata* Stein, the male

having the dense fringe at tip of front tibia of the former and the remarkably fringed hind tibia of the latter. Except for having front legs resembling those of *monilis* Hal., the male is almost indistinguishable from a specimen of *ciliata* Stein. The female differs from *monilis* (I do not know *ciliata* ♀) in the chætotaxy of hind tibiæ. In *monilis* there are only four or five antero-ventral bristles, and a row of small antero-dorsal bristles ending in a stronger one at about one-third from tip. In *bifimbriata* there are seven or eight antero-ventrals (as given by Stein in 1914 for *ciliata* ♀), and the strong antero-dorsal bristle is placed out of alignment with the row of smaller bristles (more dorsal), and quite *close to* (slightly below) *the long dorsal bristle* at middle of tibia. Length about 4·5–5·5 mm. (one ♀ only 3·5 mm.)."

Hydrotæa bispinosa Zett.

U., W. ♂ 1, visiting *Ledum*, 16. vii.

Pegomyia tenera Zett. var. *obscurior* Coll.

U., C. ♂♂ 2, on *B. nana*, 30. vi.
U., W. ♂♂ 5, ♀ 1, swept from top layer, 1. vii.
U., W. ♂♂ 3, ♀♀ 3, shrub layer, 2. vii.
U., Mt. ♂ 1, birch-lichen mat, 3. vii.
U., Mr. 10. vii, ♂ 1, sweep II ; ♂ 1, flying over willow scrub ; ♂ 1, hovering over *B. nana*.
U., W. On *Salix*, ♂♂ 2, ♀♀ 3, 14. vii. ; ♂ 1, 15. vii. ; ♂♂ 2, ♀ 1, 16. vii. ; ♂♂ 2, ♀♀ 3, 17. vii.
U., W. 20. vii, ♂ 1, ♀ 1, sweep, shrub layer ; ♂ 1, visiting *Cerastium*.
U., C. ♀ 1, 10. vii. ; ♀♀ 3, 21. vii.

Pegomyia sp. ?

U., W. ♂ 1, on *Salix*, 14. vii.

Pegohylemyia profuga Stein.

U., W. ♂♂ 2, shrub layer, 2. vii.
U., W. ♂ 1, flying over willow scrub, 10. vii.
U., W. ♀♀ 2, shrub layer, 14. vii.
U., W. ♂♂ 3, on *Salix*, 17. vii.
U., C. ♂ 1, sweep of *B. nana*, 19. vii.
U., C. ♀♀ 3, 21. vii.

Paregle radicum L.

U., C. ♀♀ 5, on dung, 16. vii.
L., G. ♀♀ 2, on dung, 10. viii.
L., G. ♀♀ 3, 24. viii.

Delia octoguttata Zett.

U., Mt. ♂ 1, birch-lichen mat, 27. vi.
U., Mt. ♀ 1, birch-lichen mat, 3. vii.
L., G. ♀ 1, 24. viii.

Delia sp. (? *fabricii* Holmg.).

U., C. ♀ 1, sweep of *B. nana*, 19. vii.
L., G. ♀ 1, on dung, 10. viii.
L., H. ♀♀ 3, on *B. nana*, 24. viii.

Fucellia intermedia Ludbk.

U. On shore, drift-line seaweed, D.M.S., ♂♂ 3, 10. vii.; ♂ 1, ♀ 1, 12. vii.; ♀ 1, 13. vii., ♂ 1, ♀♀ 2, 14. vii.
U. C. ♀ 1, on dung, 14. vii.
U., C. ♂♂ 2, on dung, 16. vii.

Fucellia fucorum Fln.

U. ♂♂ 2, on shore, drift-line seaweed, D.M.S., 10. vii.

Tachinidæ.

Tenuirostra arctica Sack.

U., Mt. ♂ 1, birch-lichen mat, 2. vii.

Phormia grœnlandica Zett.

U. ♂ 1, on shore, drift-line seaweed, D.M.S., 15. vii.

Phormia atriceps Zett.

U., Mt. ♀♀ 2, birch-lichen mat, 27. vi.
U. On shore, drift-line seaweed, D.M.S., ♀♀; 2, 10. vii.; 1, 13. vii.; 1, 14. vii.; 3, 15. vii.

Calliphora uralensis Vill.

U., C. ♀ 1, on dung or food, 2. vii; ♀ 1, 10. vii.
U. ♀ 1, on shore, drift-line seaweed, D.M.S., 12. vii.; ♀ 1, 14. vii.; ♂ 1, 15. vii.
U., C. ♀♀ 3, on food, 14. vii.

U., C. ♂♂ 5, ♀ 1, on dung or food, 16. vii. , ♀ 1, 18. vii
L., W. ♀ 1, on *Salix*, 11. viii.
L., G. ♂ 1, ♀ 1, 24. viii.

APHANIPTERA.

Ceratophyllidæ.

**Ceratophyllus borealis* Rthsch.

Utorkait, from Snow-Bunting.

Apparently not previously recorded from Greenland. Rothschild (1915, Ent. Mon. Mag. li. p. 71) says: "A rare species, apparently confined to Great Britain, and so far only recorded from Scotland from the nests of the Rock-Pipit (*Anthus obscurus*), the Gannet (*Sula barrana*), and some other birds." I have not found any mention of it in lists of Greenland fauna, and Dr. Jordan kindly informs me that he knows of no record of *C. borealis* from Greenland.

32

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 11, vol. iii. p. 60, *January* 1939.

INSECTA AND ARANEÆ COLLECTED IN THE KANGERDLUGSUAK REGION OF EAST GREENLAND BY THE BRITISH EXPEDITION, 1935-36.

Insecta and Araneæ collected in the Kangerdlugsuak Region of East Greenland by the British Expedition, 1935–36. By G. D. HALE CARPENTER, D.M. (Hope Professor of Zoology (Entomology) in the University of Oxford), and ÅKE HOLM (Uppsala Universitets Zoologiska Institution).

FOREWORD (G. D. H. C.).

The specimens discussed in this paper were collected by members of the expedition under Mr. L. R. Wager, F.R.G.S., who gave an account of it in 1937 (Geogr. Journ. xc. (5) pp. 393–415). They were presented by Mr. Wager to the Oxford University Museum on the understanding that the British Museum (Natural History) should have what it needed. My part has been only to supervise mounting, prepare the drafts of the labels, distribute the specimens for identification, and correlate the results.

Grateful acknowledgements are here made to the following experts, who have most kindly identified the specimens;—Benson, R. B.; Brown, J. M.; China, W. E.;

Collin, J. E.; Condé, O.; Edwards, F. W.; Laing, F.; Prout, L. B.; Richards, O. W.; Roman, A.; Stringer, H.; Tams, W. H. T.; Thienemann, A.; Thompson, G. B.

The Araneæ are described by Mr. Åke Holm in the second part of this paper; the single species of *Ixodoidea* has been discussed by Professor P. Schulze (Rostock) †; the Acarina, at the time of writing, are in the hands of Dr. Ivar Trägårdh of Stockholm, who, unfortunately, has been prevented by ill-health and stress of other work from sending his promised account in time for this paper which has already been long delayed on its behalf.

A single species of Gasteropod mollusc was identified by Mr. G. I. Crawford, of the British Museum (Natural History), as *Vitrina angelica* Mosch.

In order that frequent repetition may be avoided the localities from which the insects were received are listed below, and will subsequently be quoted by number only; they are all to be found on Wager's maps. Data are thus available for an ecological study of the collection.

The base was on Skaergaard peninsula, at the eastern side of the entrance to Kangerdlugsuak Fjord, about 12 miles north-east of the meeting of parallels 32° E. and 68° N.

List of Localities.

1. Base, sea-level.
2. ,, 50 feet elevation.
3. ,, 150 ,, ,,
4. ,, 200 ,, ,,
5. ,, 300 ,, ,,
6. ,, 50 feet west of.
7. ,, south of, sea-level.
8. ,, ,, ,, 300 feet elevation.
9. ,, east of, sea-level.
10. ,, ,, ,, 50 feet elevation.
11. ,, ,, ,, 100 ,, ,,
12. ,, ,, ,, 200 ,, ,,
13. ,, ,, ,, 300 ,, ,,
14. Kraemer's Isle, Kraemer's Bay on south, sea-level to 1000 feet.

† P. Schulze, 1938, "Über die 'bipolare' Zecke *Ceratixodes uriæ* (White)=*putus* (Pick.-Cambr.)." Zoologischer Anzeiger, Bd. 123, Heft. 1/2, pp. 12–17.

15. Kraemer's Isle, Kraemer's Bay on south, *circa* 300 feet elevation.
16. Miki Fjord, north bank, 50 feet elevation.
17. ,, ,, east end of lake valley, sea-level.
18. Hutchinson glacier, 2500 feet elevation.
19. Citadel, 2000 feet.
20. South Syenite glacier, sea-level.
21. ,, ,, ,, 1500 feet elevation.
22. ,, ,, ,, 2000 ,, ,,
23. ,, ,, ,, 2500 ,, ,,
24. North Syenite glacier, foot of, sea-level.
25. Mudderbugt (Muddy Bay), sea-level.
26. Notch mountain, *circa* 12 miles west of, 3800 feet elevation.
27. Notch mountain, *circa* 17½ miles west of, 3000 feet elevation.
28. Calving glacier, west of, 5½ miles inland, 3000 feet elevation.
29. Summer journey inland, 30 miles from coast, 4500 feet elevation.
30. Summer journey inland, 48 miles from coast, 4300–4500 feet elevation.
31. Summer journey inland, 50 miles from coast, 4500–4600 feet elevation.
32. Summer journey inland, 60 miles from coast, 5000 feet elevation.
33. Summer journey inland, 65 miles from coast, 5100 feet elevation.
34. Summer journey inland, 70 miles from coast, 5300–5700 feet elevation.
35. Summer journey inland, 70 miles from coast, 6500 feet elevation.
36. Jacobson Fjord, N.W. of, Camp 11, 45 miles from coast, 4500 feet elevation.

Part I. (G. D. H. C.)

The following species appear to be new records for Greenland, and are subsequently marked by *.

Collembola: *Isotoma* (*Pseudisotoma*) *sensibilis* Tullb.
,, *Isotoma* (*Vergatopus*) *arborea* (L.) Ågrew.
Hymenoptera: *Ichneumon* sp.

The insects taken by the expedition are catalogued in order of arrangement according to Imm's 'Text-book

of Entomology,' third edition, 1934. Unless otherwise stated there is one specimen for the locality and date given.

THYSANURA.

Several specimens were sent to Dr. J. Douglas Hood at Rochester University, New York, but he has, unfortunately, not found himself able either to return the specimens or to forward identifications.

COLLEMBOLA.

An account of the Collembola was included by J. M. Brown in his paper "On some Collembola from Iceland and Greenland" in 'Annals and Magazine of Natural History,' (10) xx. pp. 514–520 (1937). His arrangement is here followed, but only names and localities are given.

ARTHROPLEONA.

Hypogastruridæ.

Hypogastrura armata (Nic). **16**, 6. v. 36.

Isotoma* (*Pseudisotoma*) *sensibilis* Tullb. **14, 17. vi. 36.

Isotoma* (*Vergatopus*) *arborea* (L.) Ågrew. **14, 6. viii. 35.

HEMIPTERA.

HETEROPTERA.

Capsidæ.

Chlamydatus pulicarius (Fall). One first stage larva. **25**, 29. vi. 36.

HOMOPTERA.

Coccidæ.

Orthezia cataphracta Shaw. **7**, under stone, 17. v. 36 : **8**, under stone, 9. vi. 36 : **16**, 12. vi. 36.

ANOPLURA.

MALLOPHAGA.

Ricinus sp. Mr. G. B. Thompson wrote of this specimen:—"It unfortunately lacks any host data. The host was in all probability a small Passerine, as this genus is characteristic of that group of birds. As there is only

a single specimen, a female, it would not be possible in the present state of the systematics of this group to give any further notes on it."

Siphunculata.

Pediculus humanus Linn. From head of Eskimo.

LEPIDOPTERA.

Tineoidea.

Plutellidæ.

Plutella dalella Stn. **1,** in hut, 7. x. 35 : **1,** in hut, 18. vii. 36 : **12,** 8. vi. 36.

Pyraloidea.

Pyraustidæ.

Pyrausta torvalis Möschl. **20,** 25. vi. 36 ; two others, 28. vi. 36 : **25,** 1. vii. 36 : **28,** 16. vii. 36 : **29,** 25. vii. 36 (*P. B. Chambers*) : **32,** 30. vii. 36, four (*P. B. Chambers*).

Papilionoidea.

Nymphalidæ.

Brenthis chariclea arctica Zett. **1,** found dead, 21. viii. 35 ; another with left fore wing missing, found dead, 22. viii. 35 ; another crippled by ill-developed wings, found dead, 2. ix. 35 ; another, 9. ix. 35 ; eleven, 16. vii. 36 : **30,** 5. viii. 36 (*P. B. Chambers*).

Geometroidea.

Geometridæ.

Entephria polata punctipes Curt., ♂ approaching ab. *brullei* Lef. **29,** 25. vii. 36 (*P. B. Chambers*).

Eupithecia gelidata Moschl. **2,** on rock, 1. vi. 36, two : **6,** 14. vi. 36 : **9,** 8. vi. 36 : **14,** 17. vi. 36, eleven : **20,** 26. vi. 36, two : **25,** 29. vi. 36 ; two others, 3. vii. 36.

Noctuoidea.

Noctuidæ.

Eumichtis sommeri Led. **1,** 16. vii. 36 ; another, 6. viii. 36 : **11,** 15. vi. 36 : **18,** 10. vii. 36 : **19,** 12. vii. 36,

Anarta richardsoni richardsoni Curtis. **20,** 27. vi. 36 : **28,** 16. vii. 36 : **30,** 5. viii. 36 : **32,** 30. vii. 36 (*P. B. Chambers*) : **36,** 19. viii. 35.

Crymodes exulis Lef. **19,** 12. vii. 36.

COLEOPTERA.

Diversicornia.

Coccinellidæ.

Coccinella transversoguttata Feld. **20,** 27. vi. 36 : **21,** 28. vi. 36 : **23,** 28. vi. 36, pair *in copula*.

Byrrhidæ.

Byrrhus fasciatus Forst. **13,** 31. v. 36, under vegetation, two.

Rhynchophora.

Curculionidæ.

Otiorrhynchus arcticus F. **7,** under stones, two, 4. v. 36 ; another, 17. v. 36 ; another, 8. vi. 36 : **10,** 12. vi. 36 : **13,** under stones, 12. v. 36 ; another, 17. v. 36 : another, 24. v. 36 ; another, 29. v. 36 ; another, 12. vi. 36 : **16,** four, under stone, 12. vi. 36 : **21,** 28. vi. 36.

HYMENOPTERA.

Symphyta.

Tenthredinidæ.

Amauronematus ? form of *pallicercus* Htg. **22,** 27. vi. 36, abundant.

The specimen, on the advice of Mr. R. B. Benson, was sent to Herr O. Condé, who is working on this group. He kindly replied that it is perhaps a form of *pallicercus*, but differs from typical Central European specimens in having its head narrower than the thorax, whereas in the latter the head is generally as broad or broader. The saw is about twice as broad as that of a Central European specimen ; specimens from Kamschatka and from Letland have the saw nearly equally broad, but the head is broader. Herr Condé wrote that this single specimen does not constitute by itself good enough material for a name ; if more specimens were found

with similar characters of head and saw, and agreeing with it in being entirely black, with only the knee and inside of the tibia slightly brown, a subspecies might be established.

Pristiphora sp.

Herr Condé reported that the single specimen was probably an American species ; it was sent to America for further examination, but has not been returned at the time of writing.

APOCRITA

Ichneumonoidea.

Ichneumonidæ.

Ichneumoninæ.

[Notes by A. Roman.]

Ichneumon* sp. **22, 27. vi. 36, " abundant."

Dr. Roman wrote of this female specimen :—" This I expect is an American species, neither *aurivillii* mihi nor *discoensis* Fox, perhaps already described. It has the short-jointed, filiform antennæ of *aurivillii* with no white ring, the thorax and abdomen black with only the tegula very dark red, the middle area of the post-petiole is strongly punctured, the legs are red with black coxæ and trochanters, visibly slenderer than in *aurivillii*. The third tarsal joint I–III is elongated, the fourth III subelongated, scopula obsolete, dark. Wings smoky with yellow stigma. Length about 11 mm. If the species was abundant it is a pity only a single specimen was secured."

Cryptinæ.

Cryptus arcticus Schdte. **1**, 17. vii. 36, female.

"A common species on all the Greenland coast, not found in Europe."

Atractodes bicolor arcticus Holmg. **1**, 3. viii. 36, female.

"A melanistic form of the commonest European species, first reported from East Greenland by myself in 1934. The Stockholm Museum has a ♀ of a pale form of this species from North America (collector Belfrage)."

Pimplidea sodalis Rthe. **14,** 17. vi. 36, two males.

"A common species on all the Greenland coast. Occurs on almost all European mountains reaching above tree limit, but is not known from North America."

Tryphoninæ.

Stenomacrus cf. *nigricornis* Boh. **29,** 25. vii. 36 (*P. B. Chambers*), two males and a female: **30,** 5. viii. (*P. B. C.*), eight males.

"This is one of the many difficult species of Thomson's fifth section. The antennæ are long-jointed, *i. e.*, the basal flagellar joints of the female are not transverse or quadrate. The postannellus is distinctly shorter than the following joint in both sexes. Head subcubical, a little narrowed behind eyes in the male. Propodeum with a rather indistinct arca media. Postpetiolus of the female parallel-sided, a little longer than broad; of the male more elongate and narrowed towards the base, in both sexes glabrous like the second tergite which is almost shorter than the first. The apical half of the abdomen is strongly compressed in the female, depressed in the male; terebra almost straight with slender sheath, which is hardly shorter than the second tergite. Wings with a rather narrow yellow stigma emitting the radius well before the middle, parallel nervure originating in or a little below centre of transverse brachial nervure.

"The species is very like *S. nigricornis* Boh. from Spitsbergen, but the antennæ are slenderer, especially in the male."

Ophioninæ.

Angitia cf. *specularis* Thoms. **20,** 5. vii. 36, one female.

"This may be the female of my *Angitia* cf. *claripennis* Thoms. of 1933, though the legs are still darker. The four posterior femora are quite black, the hind tibiæ black and white with no red. The mesopleural speculum is small but shining, the propodeum short and steep with the *arca centralis* pointed anteriorly, open behind, emitting the costulæ behind the middle. Sheath of terebra about as long as tergites two and three. Stigma transparent pale brown. Length 6 mm.; forewing 4·5 mm."

Anilasta didyma frigida Lundb. **28,** 16. vii. 36, female : **32,** 30. vii. 36, male (*P. B. Chambers*).

"As already mentioned by me (1934, Ann. & Mag. Nat. Hist. (10) xiv. pp. 610–611) there seems to be no other difference from the common European *Anilasta didymator* Thunb. than the much darker coloration of *frigida.* The style of the markings is the same and the structure identical, so I think it correct to consider *frigida* as an arctic race of *didymator.* The present male has all femora red as in the typical form."

APOIDEA.

Apidæ.

Bombus hyperboreus Schön. **20,** 26. vi. 36, female.

Bombus arcticus K. **28,** 16. vii. 36, female.

Bombus arcticus var. *groenlandicus* Sm. **1,** 17. vii. 36, worker : **12,** 10. vi. 36, female.

DIPTERA.

NEMATOCERA.

Dr. F. W. Edwards wrote of this collection : "It includes only twelve species, most, if not all, of which have previously been taken in East Greenland."

Culicidæ.

Aëdes nigripes Zett. **20,** 26. vi. 36, eleven females, marked " Abundant."

Chironomidæ.

Diamesa bertrami Edw. **2,** ix. 35, male, on rock : **2,** x. 35, three males, on snow. " Called by Eskimos Snow-bunting food" : **11,** 1. vi. 36, female, beside water.

Diamesa ursus Kieff. (?) **1,** xi. 35, female : **3,** 17. v. 36 : **11,** 1. vi. 36, two females beside water : **14,** 17. vi. 36, female ; **17,** 11. vi. 36, five females.

Diamesa bohemani (Goet.) Edw. Pupal cases and drowned adults found in sheltered pools of running water, Kangerdlugsuak, 29. viii. 35.

Diamesa aberrata Lbk. **2,** ix. 35, male, on rock : **11,** 1. vi. 36, seventeen females : **17,** 11. vi. 36, female : **25,** 29. vi., female.

The following account of pupal skins has been kindly written by Professor Thienemann :—

Herr Dr. F. W. Edwards übersandte mir 2 Proben, die von der British Expedition to E. Greenland 1935–36.

No. I—mit der Bezeichnung "1. viii. 36. Summer journey inland, circa 70 m. from coast, c. 5300–5700 ft. coll. P. B. Chambers" enthielt eine grosse Anzahl Puppenhäute, die sämtlich zu einer Art der *Diamesa*-Gruppe s. s., vielleicht *Syndiamesa* s. s. sp. gehörten. Ferner eine Larve der *Diamesa*-Gruppe s. s. (vielleicht *Syndiamesa*) und zwei, wohl zur Gattung *Metriocnemus* gehörende Orthocladiinen-larven.

No. II—" Found in sheltered pools off running water. Kangerdlugsuak, 29. viii. 35 (common)" enthielt als Imagines nach Dr. Edwards Bestimmung 4 *Diamesa*-Arten : *aberrata* Lundb., *bertrami* Edw., *bohemani* Goet, *ursus* Kieff.

Das reiche Material an Puppenhäuten, die z. T. noch die ausschlüpfenden Imagines enthielten und daher sicher bestimmt werden konnten, bestand ausschliesslich aus *einer* Art, nämlich, *D. aberrata* Lundb.

Die Puppen sind typische *Diamesa*-puppen s. s. (vergl. Zoolog. Anzeiger ciii. 1933, p. 11 ; Stett. Ent. Zeitg. xcv. 1934, p. 6) und zwar ganz ähnlich den Puppen von *D. insignipes* K., *prolongata* K., usw. Vorläufig lassen sich die verschiedenen Arten von *Diamesa* s. s. im Puppenstadium nicht unterscheiden.

Spaniotoma (*Orthocladius*) sp. **34**, 1. viii. 36, eleven females, together with pupal cases from which they were presumably bred (*P. B. Chambers*).

According to Edwards " This is very possibly *O. obscuripennis* Holmgr., the wings being very noticeably dark grey, but it is also possible, as I have suggested elsewhere, that *O. obscuripennis* is a *Heterotrissocladius* ; a re-examination of the type is needed. In the absence of the male it is difficult to place this species precisely, but in most respects it resembles the species of Group A (*Chætocladius*), differing, however, from the British species of that group in the darker wings and longer terminal segment of the antennæ, which is about as long as the preceding four segments together and without long hairs ; also in venation, *R* 2+3 ending only a short